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BIFV Squad and Platoon Leader Span of Control

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FOREWORD

Since 1975 the Army Research Institute for the Behavioral and Social Sciences (ARI) has contributed to the U.S. Army program to develop Bradley Infantry (M2) and Cavalry (M3) Fighting Vehicles with human factors evaluation of prototype vehicles and analyses of crew tasks to identify special aptitude requirements. Task analysis resulted in a set of Procedures Guides for Bradley Commanders, Gunners, and Drivers; identification of leader tactical training device requirements; and recommendations for a Bradley Leader Tactical Trainer.

As Bradley vehicles were introduced to combat units, the need to evaluate tactical doctrine, operational effectiveness, and training issues in a systems context became apparent. At the request of the Deputy Chief of Staff for Training, U.S. Army Training and Doctrine Command (TRADOC), a research program was formalized among the Training Technology Agency, TRADOC, the U.S. Army Infantry School, and the Army Research Institute to define emerging operational and training problems and to undertake research to address the most critical issues affecting combat effectiveness. Because Bradley vehicles incorporate advanced weapons systems and sights to be used in darkness and reduced visibility, special emphasis was placed on that research focused on these conditions.

The first year of the project resulted in definition of critical research issues and identified gunnery, tactical operations, equipment, and training as topical areas for subsequent research and development. The problem identification and supporting analyses are presented in a separate report.

The results of the second year of research are documented in a series of publications, of which the present report is one. The emphasis of the second-year effort was on making products available to Bradley users as they were developed. These analyses, training materials, job performance aids, improved procedures, and equipment prototypes have immediately increased combat effectiveness. Further interactions between the project scientists and the user community have resulted in additional improvements and refinements. As a result of this approach, the project has been unusually responsive to both the U.S. Army Infantry School and Bradley units worldwide.

BIFV SQUAD AND PLATOON LEADER SPAN OF CONTROL

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BIFV SQUAD AND PLATOON LEADER SPAN OF CONTROL

INTRODUCTION

The question as to whether the Bradley Infantry Fighting Vehicle (BIFV) squad and platoon leader will be able to perform all assigned duties in a crisis environment, without experiencing significant task overload, has arisen. Reports and observations from BIFV units, field research agencies and Subject Matter Experts (SMEs) as well as queries from senior Army personnel provide impetus for investigation of this question. The concern would appear to be a legitimate one in view of the many new and complex tasks the BIFV leader must now perform in addition to performance of the traditional duties required of infantry squad and platoon leaders.

The BIFV, itself, introduces new requirements for mastery of maintenance and employment skills for the vehicle, its ancillary weapon systems, and an array of equipment that demands technological competence and tactical acumen. A single BIFV possesses firepower which exceeds that found in the standard dismounted, or non-mechanized infantry platoon. The weapons systems aboard the vehicle include sophisticated sighting equipment for use during both daylight and limited visibility conditions. The TOW missile system integral to the vehicle can destroy tanks and other vehicles at distances beyond 3.5 kilometers. Other weapons that are assigned to each vehicle include antitank weapons such as the LAW and Dragon, antipersonnel and antitank mines, M-60 machine guns, squad automatic weapons (SAW), and six firing port weapons mounted to the flanks and rear of the vehicle. An organic smoke producing capability can obscure significant areas of the battlefield either singly or in concert with other similar vehicles.

Personnel assigned to the BIFV include a mounted element consisting of a driver, commander and gunner, and a dismount element of six men organized as a fire team. Both squad and platoon leaders must be capable of operating as leaders of the dismount force when it is deployed. The requirement also exists to fight the vehicle with the dismount element aboard or deployed, as well as to furnish fire support for a single squad or in support of the entire BIFV platoon.

BIFV squad and platoon leaders also must master the tactics and techniques required to perform as leaders in combined arms teams of varying composition. These may be either armor-dominant in composition and employment, or infantry-dominant but with armored elements in support. Requirements may be dramatically different dependent upon both task organization and tactical concepts employed.

Infantry squad and platoon leaders must master a wide variety of skills in addition to the above to be effective in combat. These leaders and their units may be called upon to emplace or reduce obstacles and minefields, perform mounted and dismounted land navigation, recognize and react to enemy personnel and equipment (with appropriate responses being critical to survival), perform specialized tactical missions in a wide variety of terrain and environments, call for supporting fires from artillery, air and sea resources, survive and

fight under nuclear, chemical or biological conditions, perform first aid, utilize sophisticated infrared, sonic, laser, and ambient light devices, and know the tactics and techniques required to fight in urban areas, forests, jungles, deserts and frigid artic wastes.

All of the above requirements for competence, proficiency and ability must be developed within an individual who has already demonstrated a significant degree of leadership and maturity. Leadership of men demands a knowledge of and sensitivity to human relationships. Good leaders must be compassionate as well as tough, caring as well as competent, and charismatic as well as exemplary in their own conduct.

The vicissitudes of combat also demand leaders who can remain calm in the face of danger, respond logically in periods of crisis and make rational decisions while tired, hungry, fearful, and emotionally spent. The maturity required to exercise control over other personnel under these conditions is significant.

A number of SMEs contend that the introduction of the BIFV has not resulted in significant increases in the duties of squad and platoon leaders. This group believes that with the introduction of a new infantry fighting vehicle there has been a concomitant increase in trained personnel that the leader can assign to perform the new duties. For example, the gunner discharges the functions of target acquisition and gunnery; the driver performs both as operator of the vehicle and as maintenance specialist, aided by the entire dismount element of the squad; all firing port weapons are manned by the dismount team under the supervision of the assistant squad leader; and, most important, the assistant squad leader replaces the squad leader in the turret when the squad leader is absent or dismounted to command the dismount element. The platoon leader, too, has a driver, a gunner and a replacement commander for the vehicle whenever the platoon leader must dismount. In addition, the platoon leader's mounted responsibilities for command of the four BIFVs are assumed by the platoon sergeant whenever the platoon leader dismounts.

Given that the BIFV community is divided on this issue, and given all of the above described traits expected of the BIFV squad and platoon leader, it was considered appropriate to investigate whether the advent of the BIFV and its ancillary equipment has created a set of conditions under which leaders are no longer able to perform all traditionally assigned and newly emerging duties. Recent concerns about whether the BIFV squad and platoon leader can dismount to lead dismounted elements and still retain responsibility for directing the fires of the BIFV(s) assigned to their elements is a further impetus to the need for investigation.

In July 1985, during the course of an In Process Review (IPR) conducted for the Commanding General of the Infantry Center and for the Commanding Officer of the 29th Infantry Regiment, the ARI BIFV Research Team recommended conduct of a field test to examine the issue of span of control for BIFV squad and platoon leaders. This recommendation was approved, and the BIFV Research Team began development of an Outline Test Plan. The Plan establishes procedures designed to observe, measure and record the actions of BIFV squad and platoon leaders in an extended tactical environment which, to the degree possible, replicates the crisis conditions of combat.

APPROACH

Development of the Outline Test Plan (OTP) was aided by experience gained during ARTEPs previously observed in Europe and CONUS, by discussions with SMEs from U.S. Army Infantry School (USAIS) and BIFV tactical units, and by review of existing training literature from a variety of sources. The most critical task was to prepare check sheets which would permit appropriate observation of the leadership actions, interactions and reactions to specific tactical conditions. The field test was determined to require at least a 72-hour period to introduce the proper degree of exhaustion and stress. Tactical scenarios were developed which would elicit required responses to measure abilities of leaders in performance of required tasks. It was concluded that four tactical situations could provide sufficient leader action to measure the preponderance of the skills required. The four scenarios are: (a) movement to contact/hasty attack; (b) hasty defense; (c) delay; and, (d) deliberate defense. Each of these situations would require resolution of tactical problems posed by terrain, weather, equipment and effective utilization of an aggressor force as a training aid.

This test was designed to provide for observation and measurement of BIFV squad and platoon leader reaction to realistic tactical stimuli in a field environment. Observations and measurements obtained were analyzed to determine whether these leaders are able to perform required combat duties over extended periods of time. Results obtained will serve as a base for subsequent and more sophisticated testing of similar tactical elements in major field exercises. However, data obtained in this test phase provided meaningful insights about the maximum span of control of tested leaders and may assist in identification of both procedures and techniques to assist such leaders in duty performance.

This test also permitted the BIFV Research Team to simultaneously test many other concepts and items of equipment, thereby maximizing the use of the assigned troops and equipment. Priority was given to examination of squad and platoon leader reaction to tactical situations. However, the major test aim of investigating platoon/squad leader span of control was accomplished with efficient use of test resources to simultaneously test the following items of equipment: (a) a new combat vest and pack for use by BIFV infantrymen; (b) new infrared pulse devices (tradename, Fireflys); (c) BETA route markers, (d) chemical lights (cyalume), (e) new night vision goggles sensitive to both infrared and ambient light (designed by the Wild Corporation of Switzerland); (f) laser communicators produced as prototype items by Loral Corporation, and (g) a new transparent cargo hatch dome developed by ARI/Litton to provide improved security and passive air defense.

Previous visits to tactical units engaged in major field exercises in both Europe and CONUS indicated that within newly created BIFV units there were numerous control difficulties experienced by squad and platoon leaders. These difficulties included tactical leadership errors of omission and commission. Subsequent observations by members of the USAIS departments and other military personnel tended to confirm original observations and indicated little progress had been made in correction of these deficiencies.

Based upon the above, and with the approval of USAIS, it was decided that this test would be conducted to measure leader response to tactical scenarios

and provide at least rough determinations as to the ability of squad and platoon leaders to perform currently assigned duties.

PROCEDURE

The research team balanced the competing requirements to: (a) design a test environment that would optimize collection of objective and comprehensive data; and (b) ensure that the scope of the planned research did not exceed practical considerations of availability of vehicles and personnel. The major elements of the methodology included development of tactical scenarios for a field exercise that would bring the leader span of control issue into play, preparation and rehearsal of an observer team and chief controller, and development of data collection instruments.

Tactical Scenarios

The field test was determined to require at least two days of continuous operations to introduce the proper degree of exhaustion and stress. Tactical scenarios were developed which would elicit the types of responses required to measure abilities of leaders in performance of required tasks. It was concluded that four tactical situations could provide sufficient leader action to measure the preponderance of the skills required. The four scenarios are: (a) movement to contact/hasty attack; (b) hasty defense; (c) delay; and, (d) deliberate defense. Each of these situations would require resolution of tactical problems posed by terrain, weather, equipment and effective utilization of an aggressor force as a training aid.

In brief, the 3-day plan for the exercise followed the schedule below:

DAY 1	Assembly Area Movement to Contact Limited Objective Attack Hasty Defense
DAY 2	Receive Order for Deliberate Defense Move and Prepare Deliberate Defense (0700 hours) Conduct Defense (1700 hours Receive Order for Delay in Zone--Delay Commence 2200 hours.
DAY 3	Delay; (2200 hours Day 2 until 0600 hours Day 3) Delay from three positions Hasty Defense (0600 hours to 0900 hours) Patrols and Probes--Day and Night Recieve Order for Conduct of Deliberate Defense Prepare Deliberate Defense Receive Aggressor Fires and Attack Repel Attack, Reorganize and Consolidate ENDEX--1600 hours

Test Units and Exercise Site

Testing was conducted in Training Area OSCAR at Fort Benning (an area approximately eleven kilometers long by six kilometers wide). The area was ideal for the test because it provided a significant variety of terrain including large open areas that were especially favorable for hasty and deliberate defensive operations, secondary roads, densely forested patches, sharply defined defiles and broken ground, small streams, and boggy areas. These conditions were ideal for the conduct of tactical scenarios involving movement to contact, meeting engagements, ambushes, limited objective attacks, mounted and dismounted deliberate attacks, and delay operations.

A platoon from Company D, 1st Battalion, 29th Infantry Regiment was employed as the friendly force. The platoon was reinforced with a normal augmentation of an enlisted forward observer and a medic. Equipment, essentially, paralleled that found in a TO&E platoon, except for: night vision devices; NBC protective clothing or masks; and radios for use by the dismount element of each BIFV. Personnel were at full strength, which permitted complete assessment of span of control responsibilities of squad and platoon leaders.

The Aggressor force consisted of a platoon headquarters section and two squads from another platoon of Company D, 1st Battalion, 29th Infantry Regiment. This force performed as a "training aid" for the purpose of the test. The aggressor force commander placed his troops and equipment in positions, and performed the type of maneuver requested by the Chief Controller. This permitted development of scenarios which placed maximum stress on the friendly force and produced reactions which could be measured/observed/recorded with fidelity.

Observation Procedures

An observer was assigned to the platoon leader and each squad leader (for a total of 4 observers). The Chief Controller acted as the company commander for the friendly platoon, provided requisite instructions to the aggressor force, served as the FIST representative for both sides of the exercise, directed and supervised reissue of training ammunition (to coincide with normal deliverys anticipated in a combat environment), processed and returned prisoners to parent units, kept observers and leaders apprised of tactical requirements and control actions required, and coordinated all activities where representation of higher or adjacent units was necessary.

Observer personnel possessed significant prior military service and were familiar with BIFV operations and the functions of the leaders they observed. Observation was continuous from the start of the exercise to its termination. Observer personnel were trained prior to the start of the exercise on the tactical scenario that was to be employed. During this observer training period a series of check lists (observation protocols) which had been prepared for each tactical situation, were used as the basic training vehicle. Each tactical requirement was discussed in detail, and the anticipated range of actions each leader might select for a given situation was covered.

A critical part of the observer role was to record the actions and orders of the leader he was assigned to monitor. Observers were not to provide leaders with any assistance, advice or information. This requirement was emphasized both before and during the test, and was successfully implemented. Although leaders initially solicited such help they became aware, quite quickly, that queries of observers were not fruitful. Soon they accepted the observer as a shadow that would be near them throughout the exercise and, over time, almost failed to notice the observer's presence.

The checklists cited above had been prepared well in advance of the test. They served as the basis for recording observations and had been prepared in such detail that many standard tactical functions which were totally routinized could be indicated as performed or not by use of a simple check-off. Other functions which required completion of a series of actions demanded more input from the observer and the checklist provided prompts for this requirement. The items measured by the checklist were: (a) leadership--including the interactions with subordinates and superiors required for implementation of orders issued; (b) job knowledge--the technical and tactical proficiency required to perform a variety of missions; (c) maintenance--the ability to supervise necessary maintenance of the BIFV and associated weapons and equipment systems; (d) tactics--knowledge of the tactics and techniques necessary to combine firepower, personnel and maneuver to accomplish the mission.

After termination of the test these checklists became the basis for post-test analysis and report preparation. They were the permanent record and the basis for all analysis of leader performance. A copy of the Outline Test Plan, which includes tactical scenarios, support requirements, checklists, and similar data is available at Appendixes A-C.

Satellite Tests

The BIFV Research Team determined that it was possible to maximize the use of the assigned troops and equipment by simultaneously testing many concepts and items of equipment considered to have a potential for employment with BIFV units. However, priority was given to examination of squad and platoon leader reaction to tactical situations, and no interference with this test goal was allowed. Since the major test aim of investigating the squad and platoon leader span of control could be accomplished with efficient use of test resources to simultaneously test other items, the following items of equipment were selected:

1. WILD Night Vision Goggles: Similar to the Army AN/PVS 5, these offer greater range, better image display and lighter weight. One set was issued to each squad and platoon leader (and to the Aggressor force) for use in night operations. For description of the device and a report on its performance, see Appendix E.
2. FIREFLY: Trade name for a small, light, infrared emission device powered by a standard issue Army BA90 battery. This device projects a pulsating or a constant wave infrared beam for distances in excess of 5 km. The device was tested for potential as a means of effecting friendly force

recognition at night and under limited visibility conditions. For description of the device and a report on its performance, see Appendix E.

3. BIFV Vest and Pack: A new Army vest and pack designed by Natick Laboratories was tested for use by BIFV squad members. In addition, a vest and pack designed by Adventures, Inc., also was tested to determine the characteristics required in a vest and pack assembly for the BIFV soldier. Testing was not designed to measure superiority of one pack over another, but to determine those factors that could best meet the needs of an individual who must fight from within the BIFV as well as engage in dismounted combat for extended periods of time. For description of these items and a report on their performance, see Appendix E.

4. Transparent Dome: A new bullet proof dome designed by ARI/Litton. Design and prototype construction performed to respond to a USAIS request for increased troop compartment visibility, improved local security observation, and provision of a passive air defense observation potential to the rear of the BIFV. For a description of the device and a report on its performance, see Bibliography.

DISCUSSION

The field test created the tactical conditions under which measurement of squad/platoon leader span of control was possible. The three-day test duration, the movement and physical activity required, the interjection of significant numbers of night situations, and the amount of on and off vehicle movement which was generated provided situations under which troop fatigue was a very real condition. The variety of combat tactical scenarios presented to the friendly force tested leader reaction in a most realistic manner. The weather, too, became a factor as wind, rain and low temperatures changed soil conditions, and increased leader requirements to exercise concern for the well-being of their troops.

It should be emphasized that the tested platoon is not a tactical force in the same context as a TO&E platoon assigned to a line company and battalion. Although personnel were organic to the tested platoon, their normal duties involve provision of support to USAIS instruction for resident career and specialty courses. Personnel do work on BIFV activities as part of their normal duties, but not as complete tactical entities. Therefore, there was a period of adjustment required before the unit became a cohesive tactical force despite the fact that individuals and leaders were thoroughly conversant with the duties expected of them in a tactical context. Indeed, it was a matter for comment by each of the observers that tested leaders and troops fell into a tactical routine much more quickly than anticipated. Morale and esprit were very high, and troops met requirements with more energy, resourcefulness, and competitive desire than in any tactical units tested by the research team in the past.

As a TDA unit, Company D did not have a tactical SOP to cover routine tactical procedures, nor would one be practical or expected. Within a TO&E BIFV company such a document is essential for rapid reaction to tactical situations. However, it was interesting to note that as the exercise

progressed leaders fell into a routine for response to test scenarios which closely resembled responses to be found in a tactical SOP. In the Movement to Contact phase of the test improvisation was most apparent; the situation dictated a significant amount of dismount activity to screen heavily vegetated areas along the axis of advance and squads developed a system in which squad leaders and assistant squad leaders took turns commanding the BIFV and the dismount element. This became a routine, and its impact lasted throughout the exercise as similar situations arose.

A majority of the tactical errors made by the platoon leader and his subordinate squad leaders occurred during the initial phase of the exercise. As confidence grew, leaders became more aggressive and teamwork emerged. Despite fatigue, long hours, adverse weather (rain, mud and damp cold), leader reaction improved almost exponentially as the exercise progressed. However, a number of errors were not susceptible to correction since leaders did not possess the basic knowledge necessary for improved performance. Examples of this type of error included failure to prepare range cards (or, in the one case where a range card was prepared by a squad leader, preparation of a very inaccurate and incomplete one), poor sector sketches, inadequate fire support planning, and limited use of available potential obstacles for both defensive and delay type operations.

Other observed errors/mistakes/failures that could have been addressed and corrected by leaders included poor combat loading of the BIFV, clutter and poor equipment stowage within the troop compartment, failure to orient personnel on the tactical situation, not assigning sectors of fire for individual riflemen in defensive operations, not posting local security for the BIFV each time the vehicle halted, and almost total failure to properly safeguard and process prisoners (bringing them into main defensive positions without blindfolds, no search of prisoners, and no effort to segregate).

A basic aim of the test was to determine whether squad and platoon leaders had sufficient time to perform required duties in a combat environment. There was a strongly felt consensus among observer personnel that errors of omission and commission did not result from time or situational pressures. Errors of the type cited above appeared to be products of lack of knowledge rather than mistakes produced as a result of crisis conditions or lack of time for performance. Indeed, there was significant speculation among the observers that a good combat leaders guide prompting the appropriate action would have assisted materially in accomplishment of assigned tasks.

During the Movement to Contact, as previously noted, the terrain dictated frequent dismount of individual squads to clear areas of potential enemy resistance. In one of these squads, control of the fires of the BIFV were retained by the dismounted leader who had managed to obtain an extra PRC 77 prior to the start of the exercise (by TO&E a dismount radio would have been available for use by the dismount element of every squad). The terrain was such that section or platoon control of fires of individual BIFVs was neither practical nor desirable. The dismount leader was able to remain in radio contact with the mounted element and called for fires, movement and/or maneuver without difficulty even while continuing to direct the movement of the remainder of the dismounted riflemen. For those remaining squads which did not have an additional radio for dismounted use, there was little help which the

vehicle could provide. Lack of communication between the mounted and dismounted elements resulted in longer reaction time and less effective employment of fires of the BIFV; in combat, these factors would have produced more casualties. The number of times when the fires of BIFV sections and platoons can be employed in coordinated manner dictate control by section/platoon a majority of the time. However, when operating in woods, dense under-brush, deeply corrugated areas, some urban terrain and, most important, in periods of limited visibility or darkness, there is a very strong possibility that individual squad leader control of his vehicle's fires may represent the most effective utilization of personnel and firepower under a number of specific tactical conditions. Further research of this area would appear to have promise for maximization of the BIFV system. In addition to the discussion of major issues relating to the test as outlined above, the following specific deficiencies were observed and are considered of sufficient importance to be cited:

- Initial hasty defense positions selected on day one of the exercise were very poor. Instead of preparing a position which commanded the terrain, the platoon leader elected to go into a perimeter defense within a wooded area from which fields of fire and observation were restricted. The position could not have been held for any length of time.
- During an ambush conducted by the Aggressor on the first day, both the platoon leader and platoon sergeant went forward with the dismount element. This left the BIFVs without effective control.
- Air defense ranged from limited to non-existent until after the unit sustained its first air attack. From that moment on, the air watch was superior.
- During day one dismount operations the dismount elements were unsure of their responsibilities. Elements crossed in front of each other, became confused and, in at least one case, were unable to find their BIFV for quite a few minutes.
- Clutter and disorganization within the troop compartment was a problem throughout the exercise. Squad leaders and assistant squad leaders failed to force personnel to adhere to loading plans and troops were permitted to place equipment haphazardly.
- Failure to make range cards and/or designate sectors of fire caused positions to be less effective than they should have been. Often all the weapons were trained on the most open areas and the most dangerous locations (draws, wooded areas) were almost ignored.

Discussion of only the mistakes made by the tested unit would not provide the total perspective required for a test of this nature. The most remarkable aspect of the test was that a non-TO&E organization could perform so many of the tactical, leadership and technical tasks with the degree of effectiveness displayed by this platoon. Most of the leaders were instructors or support force personnel for BIFV instruction within the Infantry School, and selection for such positions implies a more mature, trained and capable group than might

be found in a tactical unit counterpart. However, this unit did not operate as a tactical entity in its normal day to day operations and its participation in this test represented the first time it had operated in such a capacity.

Just as major deficiencies and failures are indices of performance, those instances in which a unit performs beyond normal expectations should be cited. Examples of exemplary performance, not previously discussed, include the following:

- Individual squads and the platoon headquarters recognized the danger implicit in remaining "roadbound" during the movement to contact. As a result, the platoon was divided into two sections and operated with a section on each side of the main axis of advance. This technique took the aggressor by surprise and led to the capture of both dismount elements and, in one case, a BIFV.
- The combination of a very intelligent platoon leader and a very experienced platoon sergeant led to consultation on each phase of the test. The result was that, with the exception of the initial hasty defense position, every tactical disposition of forces was well thought out and positions selected maximized both fires and observation.
- Positions for the deliberate defense on the second day were prepared to the degree that every dismounted fighting position was both dug in and camouflaged. Each position was sited to emphasize observation and fields of fire.
- Personnel remained enthusiastic and motivated throughout the test. Morale was extremely high and troops exercised more vigilance and aggressiveness than previously observed by the research team.

CONCLUSIONS

The information recorded by the team of observers and the chief controller support the following conclusions:

- The tactical test provided an adequate base for measurement of the critical span of control issues;
- The tactical setting and duration of the exercise were sufficient to simulate the combat/stress conditions required;
- There was no specific area of measurement in which leader performance errors could be attributed directly to fatigue, stress or preoccupation with other critical issues;
- Failures of omission or commission appeared to be reflective of knowledge deficiencies or memory failure, not lack of time or crisis-invoked situations;
- Current duties assigned to BIFV squad and platoon leaders are considered to be well within their capability and capacity;

- There is a need for a functional combat leaders guide which can provide a "checklist" type of formatting of leader duties by subject areas.
- There is a need for simplified tactical training scenarios that:
 - (1) expose leaders (and especially squad leaders) to tactical leadership requirements and principles while participating in a tactical exercise without troops;
 - (2) permits detailed observation of student performance and opportunity for extensive post-scenario critique.

RECOMMENDATIONS

Based upon the data acquired during the course of research into the issue of leader span of control, the following recommendations are made for improvement in leader training:

- Development of a Leaders Guide for use by BIFV Squad and Platoon Leaders.
- BIFV Tactical Exercises Without Troops (TEWT) should be developed and used in instruction of BIFV leaders in resident instruction at USAIS and in BNCOOC, ANCOC and BIFV career development courses.
- Current tactics include provision for those conditions under which squad leaders will be required to both direct the maneuver of the squad dismount element and the fires of the squad BIFV.

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The accomplishments of the project to date are documented in a series of publications, of which the present report is one. Other publications in the series are listed below for reference.

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APPENDIX A

OUTLINE TEST PLAN (OTP) NUMBER 8

TEST TITLE: BIFV Platoon/Squad Leader Tactical Capabilities.

TOPICAL PROBLEM AREA: BIFV Leader Span of Control.

INTRODUCTION

The question as to whether the Bradley Infantry Fighting Vehicle (BIFV) squad and platoon leader will be able to perform all assigned duties in a crisis environment, without experiencing significant task overload, has arisen. Reports and observations from BIFV units, field research agencies and Subject Matter Experts (SMEs) as well as queries from senior Army personnel provide impetus for investigation of this question. The concern would appear to be a legitimate one in view of the many new and complex tasks the BIFV leader must now perform in addition to performance of the traditional duties required of infantry squad and platoon leaders.

The BIFV, itself, introduces new requirements for mastery of maintenance and employment skills for the vehicle, its ancillary weapon systems, and an array of equipment that demands technological competence and tactical acumen. A single BIFV possesses more firepower potential than that found in the standard dismounted, or non-mechanized infantry platoon. The weapons systems aboard the vehicle include sophisticated sighting equipment for use during both daylight and limited visibility conditions. The TOW missile system integral to the vehicle can destroy tanks and other vehicles at distances beyond 3.5 kilometers. Other weapons that are assigned to each vehicle include antitank weapons such as the LAW and Dragon, antipersonnel and antitank mines, M-60 machine guns, squad automatic weapons (SAW), and six firing port weapons mounted to the flanks and rear of the vehicle. An organic smoke-producing capability can obscure significant areas of the battlefield either singly or in concert with other similar vehicles.

Personnel assigned to the BIFV include a mounted element consisting of a driver, commander and gunner, and a dismount element of six men organized as a fire team. Both squad and platoon leaders must be capable of operating as leaders of the dismount force when it is deployed. The requirement also exists to fight the vehicle with the dismount element aboard or deployed, as well as to furnish fire support for a single squad or in support of the entire BIFV platoon.

BIFV squad and platoon leaders also must master the tactics and techniques required to perform as leaders in combined arms teams of varying composition. These may be either armor-dominant in composition and employment, or infantry-dominant but with armored elements in support. Requirements may be dramatically different dependent upon both task organization and tactical concepts employed.

Infantry squad and platoon leaders must master a wide variety of skills in addition to the above to be effective in combat. These leaders and their units may be called upon to emplace or reduce obstacles and minefields, perform

mounted and dismounted land navigation, recognize and react to enemy personnel and equipment (with appropriate responses being critical to survival), perform specialized tactical missions in a wide variety of terrain and environments, call for supporting fires from artillery, air and sea resources, survive and fight under nuclear, chemical or biological conditions, perform first aid, utilize sophisticated infrared, sonic, laser, and ambient light devices, and know the tactics and techniques required to fight in urban areas, forests, jungles, deserts and frigid artic wastes.

All of the above requirements for competence, proficiency and ability must be developed within an individual who has already demonstrated a significant degree of leadership and maturity. Leadership of men demands a knowledge of and sensitivity to human relationships. Good leaders must be compassionate as well as tough, caring as well as competent, and charismatic as well as exemplary in their own conduct.

The vicissitudes of combat also demand leaders who can remain calm in the face of danger, respond logically in periods of crisis and make rational decisions while tired, hungry, fearful, and emotionally spent. The maturity required to exercise control over other personnel under these conditions is significant.

A number of SMEs contend that the introduction of the BIFV has not resulted in significant increases in the duties of squad and platoon leaders. This group believes that with the introduction of a new infantry fighting vehicle there has been a concomitant increase in trained personnel that the leader can assign to perform the new duties. For example, the gunner discharges the functions of target acquisition and gunnery; the driver performs both as operator of the vehicle and as maintenance specialist--aided by the entire dismount element of the squad; all firing port weapons are manned by the dismount team under the supervision of the assistant squad leader; and, most important, the assistant squad leader replaces the squad leader in the turret when the squad leader is absent or dismounted to command the dismount element. The platoon leader, too, has a driver, a gunner and a replacement commander for the vehicle whenever the platoon leader must dismount. In addition, the platoon leader's mounted responsibilities for command of the four BIFVs are assumed by the platoon sergeant whenever the platoon leader dismounts.

Given all of the above described traits expected of the BIFV squad and platoon leaders, it was considered appropriate to investigate whether the advent of the BIFV and its ancillary equipment has created a set of conditions under which leaders are no longer able to perform all traditionally assigned and newly emerging duties. Recent concerns about whether the BIFV squad and platoon leader can dismount to lead dismounted elements and still retain responsibility for directing the fires of the BIFV(s) assigned to their elements is a further impetus to the need for investigation.

In July 1985, during the course of an In Process Review (IPR) conducted for the Commanding General of the Infantry Center and for the Commanding Officer of the 29th Infantry Regiment, the ARI BIFV Research Team recommended conduct of a field test to examine the issue of span of control for BIFV squad and platoon leaders. This recommendation was approved, and the BIFV Research Team began development of an Outline Test Plan. The Plan establishes

procedures designed to observe, measure and record the actions of BIFV squad and platoon leaders in an extended tactical environment which, to the degree possible, replicates the crisis conditions of combat.

Development of the OTP was aided by experience gained during ARTEPs previously observed in Europe and CONUS, by discussions with SMEs from USAIS and BIFV tactical units, and by review of existing training literature from a variety of sources. The most critical task was to prepare check sheets which would permit appropriate observation of the leadership actions, interactions and reactions to specific tactical conditions. The field test was determined to require at least a 72-hour period to introduce the proper degree of exhaustion and stress. Tactical scenarios were developed which would elicit required responses to measure abilities of leaders in performance of required tasks. It was concluded that four tactical situations could provide sufficient leader action to measure the preponderance of the skills required. The four scenarios are: (a) movement to contact/hasty attack; (b) hasty defense; (c) delay; and, (d) deliberate defense. Each of these situations would require resolution of tactical problems posed by terrain, weather, equipment and effective utilization of an aggressor force as a training aid.

This test will permit the BIFV Research Team to maximize the use of the assigned troops and equipment by simultaneously testing many concepts and items of equipment. Priority must be given to examination of squad and platoon leader reaction to tactical situations. However, the major test aim of investigating platoon/squad leader span of control can be accomplished with efficient use of test resources to simultaneously test the following items of equipment; (a) a new combat vest and pack for use by BIFV infantrymen, (b) new infrared pulse devices (tradename, Fireflys), (c) BETA route markers, (d) chemical lights (cyalume), (e) new night vision goggles sensitive to both infrared and ambient light (designed by the Wild Corporation of Switzerland; (f) laser communicators produced as prototype items by Loral Corporation, and (g) a new transparent cargo hatch dome developed by ARI/Litton to provide improved security and passive air defense.

PURPOSE

This test is designed to provide for observation and measurement of BIFV squad and platoon leader reaction to realistic tactical stimuli in a field environment. Observations and measurements obtained will be analyzed to determine whether these leaders are able to perform required combat duties over extended periods of time. Results obtained will serve as a base for subsequent and more sophisticated testing of similar tactical elements in major field exercises. However, data obtained in this test phase will provide meaningful insights about the maximum span of control of tested leaders and may result in identification of both procedures and techniques to assist such leaders in duty performance.

In addition to the basic test of leaders as described above, a number of ARI/Litton devised/procured devices will be tested for their potential value to BIFV units.

APPROACH

Previous visits to tactical units engaged in major field exercises in both Europe and CONUS indicated that within newly created BIFV units there were numerous control difficulties experienced by squad and platoon leaders. These difficulties included tactical leadership errors of omission and commission. Subsequent observations by members of the USAIS departments and other military personnel tended to confirm original observations and indicated little progress had been made in correction of these deficiencies.

Based upon the above, and with the approval of USAIS, it was decided that this test would be conducted to measure leader response to tactical scenarios and provide at least rough determinations as to the ability of squad and platoon leaders to perform currently assigned duties.

METHOD

Observation Procedures. The test will consist of a series of observed tactical operations, conducted by a BIFV platoon. The platoon leader and squad leader will be monitored throughout these operations to determine the degree of control exercised and the timeliness of their orders.

Testing will be conducted in training area "O" (Oscar) at Fort Benning. Area Oscar provides a maneuver area eleven kilometers long by six kilometers wide. The test will begin at 28 0800 October and run continuously until 31 1600 October. The test platoon will begin the test from an assembly area and will receive a series of missions over the following three days.

Observers will be members of the ARI/Litton Bradley team. The experimental subjects will consist of a Bradley platoon with an attached Forward Observer. There will be an aggressor force consisting of two Bradley squads. The purpose of the aggressor force is to add realism to the test and to generate sufficient pressure on the platoon/squad leader to ensure a proper tactical response.

An observer will be assigned to the platoon leader vehicle and one observer to each squad (3). These observers will monitor both the orders given and their execution. The observer will neither interfere with nor advise the platoon leader or squad leaders. Observations will be recorded in accordance with the prepared checklist.

The WILD night vision goggles (Cyclops) will be issued to the platoon leader and the three squad leaders. The goggles will be used as an aid to vision during darkness and periods of limited visibility. The amount and type of use the goggles receive will be monitored by the observer. The observer will record any user comments or questions on the comment sheet provided. Test personnel who are issued the goggles will receive a questionnaire to be completed at the end of the test.

The IR Firefly will be used as an identification friend or foe device. Platoon Headquarters and each squad will be issued one Firefly. The observers will monitor the use of Fireflys on patrols and during the delay in zone where identification of friendly forces is critical. While the test is in progress,

the observers will log any user comments on the IR Firefly comment sheet. At the end of the test the platoon leader and squad leaders will complete a questionnaire.

Two different designs of combat vest and pack will be tested. One is of an ARI/Litton design, the other model is a Natick Laboratory design. The single prototype copy of the ARI/Litton vest and pack will be issued to a squad leader while the squad members will be issued the Natick packs and vests. These items will be used throughout the test. The observer will monitor the use of these items and log all user comments and questions on the pack/vest comment sheet provided. At the end of the test all pack and vest users will complete a questionnaire.

The observer on the platoon leader's vehicle will monitor the use of the transparent cargo hatch cover. The transparent cover should be used by the air guard(s) and the forward observer. The observer will log any user comments or questions on the hatch cover comment form. The personnel in the rear of the vehicle will fill out a questionnaire at the end of the test.

The Laser Communication Device will be used by the platoon leader and one squad leader. The observers will monitor the frequency and type of use. The observers will log all user comments and questions, and monitor reliability of equipment on the laser comment sheet. The platoon leader and squad leaders will complete a questionnaire at the end of the test.

Tactical Scenarios. At 29 0600 October, the test platoon will move by road march to the assembly area located at coordinates _____ in Training Area "O".

The platoon will be observed performing assembly area procedures from 0800 until 1100 hours. The platoon will then begin a movement to contact which will culminate in a limited objective attack upon the aggressor force located at coordinates _____. Upon seizing the objective, the platoon will prepare a hasty defense and remain in position overnight. During the night they will be subject to fires and probes by the aggressor force.

At 29 0700 October the platoon will receive an order to conduct a deliberate defense at coordinates _____. The platoon will then move to the site and prepare to conduct a strong point defense. Following the conduct of the defense, the order will be given to delay in zone. This operation will begin at approximately 30 2200 October.

On 30 October the delay will be conducted on at least three positions, coordinates _____. Position No. 1, _____ Position No. 2, and _____ Position No. 3. The order will be received to conduct a hasty defense. The defense will be conducted from 0600 to 0900 30 October. At this time the platoon will be ordered to conduct a deliberate defense. Upon completion of preparations, they will come under increasing aggressor fires and finally the aggressors will attack. After repelling the attack, the platoon will

reorganize and consolidate. Upon completion of the reorganization and consolidation, the test will terminate. For planning purposes, termination will be approximately 31 1600 October.

In summary, the total 3-day scenario will proceed as follows:

29 October 1985: Assembly Area (0800)
Movement to Contact
Limited Obj: Attack
Hasty Defense (O/N)

30 October 1985: Receive Order for Deliberate Defense (0700)
Move and Prepare Deliberate Defence (Strong Point)
Conduct Defense (1700 Receive Oder for Delay in Zone)
(Approximately 2200 Start Delay Operation)

31 October 1985: Delay: (From 30 2200 October to 30 0600 October)
Delay from 3 Positions
Hasty Defense (0600 - 0900)
Patrols - Probes -- Day and Night
Receive Order for Conduct of Deliberate Defense
Prepare Deliberate Defense
Receive Aggressor Fires and Attacks
Repel Attack
Reorganize and Consolidate
1600 Hours -- Terminate Problem

TEST DATES: October 29, 30, 31, 1985

MILITARY RESOURCE REQUIREMENTS:

Personnel:

- a. Test platoon: A TO&E BIFV platoon; 1st Bn, 29th Inf. Regt.
- b. Aggressors: Two (2) squads of BIFV Infantry; 1st Bn, 29th Inf. Regt.
- c. Investigators: One NCO (DOTD)

Equipment: Six fully operational BIFVs; four BIFVs for the test platoon; two BIFVs for the aggressors.

Coordinating Units, Agencies, or Directorates: 1st Bn, 29th Inf. Regt.; DOTD, USAIS

CONTRACTING AGENCY/LITTON RESOURCE REQUIREMENTS:

Investigators: Rollier, Gruber, Roberson, McLaughlin, Harbin, Wilkinson.

Equipment: Clipboards, data collection forms, radios, instructions and checklists for test groups and observers.

SUPPORT ANNEX TO OTP #8: TACTICAL TEST

1. Purpose. This annex is to provide support guidance to research and support personnel conducting activities as a part of Operational Test #8.

2. General. Conduct of the tactical (span of control) test requires an exceptional amount of logistic and other support in a number of categories. Listed in the following appendices are the categories and details.

3. Detailed Plan.

- A. Communications: See Appendix 1.
- B. Transportation: See Appendix 2.
- C. Personnel: See Appendix 3.
- D. Equipment/Ammunition: See Appendix 4.
- E. POL and Maintenance: See Appendix 5.
- F. Rations and Personal Hygiene: See Appendix 6.

TO SUPPORT ANNEX TO OPERATIONAL TEST PLAN #8

Appendix 1: Communications

1. Purpose. To identify the communications equipment that will be required for administration of OTP #8, establish responsibility for its use, provide procedural instructions governing radio use and define responsibility for safe guarding of communication equipment.
2. General. Current Army radio/telephone voice operational procedures will be employed.
3. Detailed Plan.

A. Equipment Required: Each BIFV will be equipped with all TO&E communication equipment.

The platoon leader's BIFV will have communication equipment for both platoon and company frequencies.

CUC-Vs or M151A1s will have TO&E operational communication equipment.

Tactical Operations Center (TOC) will have on hand three (3) each ANPRC/77 radios with accessory and backpacks and nine (9) spare batteries.

B. Use of BIFV and Other Vehicle Radios: All vehicle communication will be under the control of the project coordinator or assigned person.

Tactical communications procedures will be utilized by test player personnel.

D Company, 1/29th Infantry Regiment, will issue all call signs and frequencies for test.

Need frequencies for the following categories.

Platoon Leader	Call Sign
Platoon Sergeant	Call Sign
1st Squad Leader	Call Sign
2nd Squad Leader	Call Sign
3rd Squad Leader	Call Sign
Test Coordinator	
TOC	
Observer #1	Call Sign
Observer #2	Call Sign
Observer #3	Call Sign
Observer #4	Call Sign

Aggressor Platoon Leader	Call Sign
Aggressor Squad Leader #1	Call Sign
Aggressor Squad Leader #2	Call Sign

Platoon Tactical Net Frequency
Controller Net Frequency

The Net Control Station (NCS) will be the Tactical Operations Center.

TO SUPPORT ANNEX TO OPERATIONAL TEST PLAN #8

Appendix 2: Transportation

1. Purpose. To identify the transportation requirements to include test platoon, test directorate personnel and aggressor force.

2. Detailed Plans.

Transportation. The transportation required is as listed below.

- (4) BIFVs for test platoon
- (2) BIFVs for aggressor force
- (1) BIFV for test director
- (2) M151A1s for TOC and Administrative use.

As referred to in the communication appendix, all vehicles will have operational TO&E communication equipment.

Vehicles are to be loaded, topped off, dispatched and lined up in the 1/29 motor pool no later than 0800 29 October 1985.

ORDER OF MARCH: To be announced.

TO SUPPORT ANNEX TO OPERATIONAL TEST PLAN #8

Appendix 3: Personnel

Purpose. To identify the specific personnel to be involved with the tactical (span of control) test and responsibilities concerned.

Test Player Personnel:

(1) TO&E BIFV platoon complete with combat augmentation. Combat augmentation includes, forward observer, forward observer ratelo, and medic.

(2) TO&E BIFV squads with platoon leader to serve as aggressor force.

(2) Drivers for M151A1s or CUC-Vs. These vehicles will be used in conjunction with the controllers.

Test Coordinator: Mr. Bob Rollier
Tactical Operations Center: Mr. Jon Graber
Observer #1: Mr. Paul Roberson
Observer #2: Mr. Craig Wilkinson
Observer #3:
Observer #4:
Operations and Support: Mr. Wayne Harbin

Test coordinator will be in charge of entire problem. Therefore, he will be moving constantly.

Tactical Operations Center will move on change of orders.

Observers will be assigned to a particular squad and will remain with that squad for the duration of the test.

TO SUPPORT ANNEX TO OPERATIONAL TEST PLAN #8

Appendix 4: Equipment/Ammunition

Purpose. To identify specific equipment and ammunition quantities as needed.

A. Military Resource Requirements:

1. Six (6) BIFVs with complete TO&E communications
2. Two (2) CUC-Vs or M151A1s complete with communications
3. Three (3) AN-PRC/77 radios complet with accessory and backpack.
4. Nine (9) each AN-PRC/77 radio batteries
5. Blank adapters for individual and firing port weapons.

B. ARI and Litton Resource Requirements:

1. Clipboards
2. Pencils/Pens
3. Data Collection Forms
4. Flashlights with batteries
5. Water cans filled
6. MS-2 Series Two module tent
7. Personal wet weather and cold weather Gear
8. 1 Range Radio (General Electric)

C. Ammunition

1. M60 7.62mm Blank Ammo -- MLB -- 4,000
2. M16 Blank Ammo -- 4,000 rounds
3. Simulators Artillery -- 100 each
4. Smoke Pots -- 6 each
5. Flares, Hand Held -- Red 8 each
 Green 20 each
6. Smoke Grenades -- Red 8 each
 Green 8 each
 Violet 8 each

TO SUPPORT ANNEX TO OPERATIONAL TEST PLAN #8

Appendix 5: POL and Maintenance

Purpose. To identify and outline procedures to be used for refueling vehicles and observing proper preventive maintenance.

POL: Commander of troops should provide for a (49 C) POL tanker to be standing by on specific dates and times to meet at a predetermined location for the purpose of refueling without interruption of test problem.

Maintenance: Regular preventive maintenance can be accomplished at administrative halts or as time and the situation permits. Oil levels must be maintained at all times.

Oils and fluids should be requested with POL tanker or carried onboard by each BIFV squad.

TO SUPPORT ANNEX TO OPERATIONAL TEST PLAN #8

Appendix 6: Rations and Personal Hygiene

Purpose. To define the process or procedures to which rations can be consumed and personal hygiene can be accomplished.

A. Rations. The commander of troops will be responsible for issue of MREs and periods of which to consume them. Hot chow is authorized as long as the troops are fed in a tactical environment. It will be at the discretion of the commander as to which meal will be hot and how to get it to the field.

B. Personal Hygiene. Per unit SOP.

APPENDIX B
EXERCISE SCENARIO

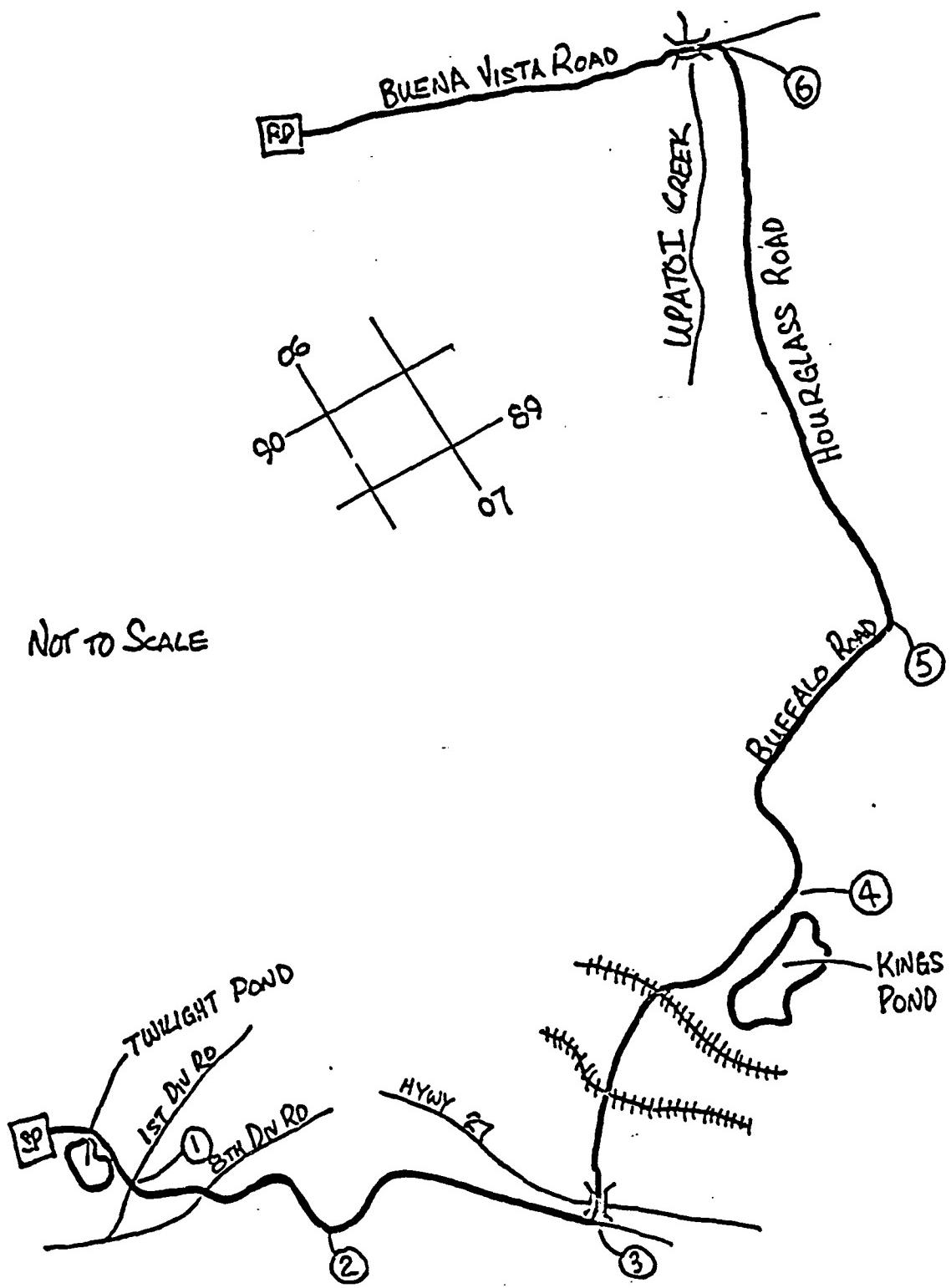
FRAGO (MVMNT to AA)
TASK ORG: D/1-29 INF

SITUATION: 3D GUARDS ARMY (GA), 17TH GUARDS DIVISION (GD), 13TH MOTORIZED RIFLE REGIMENT (MRR) OPERATING IN AREA SOUTH OF MACON RD.

ORDERS TO SUBORDINATES: CONDUCT TAC RD MARCH TO AA VIC HILL 436 (GL 0593). USE ROUTE INDICATED ON MAP.

FIRE SPT: PRIORITY OF FIRE TO D/1-29 INF.

COORDINATING INSTRUCTIONS: REPORT CROSSING SP, CP, AND RP. GET ACCOUNTABILITY OF ALL SENSITIVE ITEMS AND PERSONNEL PRIOR TO MVMNT.



OPORD 8-TM D/1-29

COPY ____ OF ____ COPIES

REFERENCE: NONE

290800OCT85

TIME ZONE: ROMEO

MAP: SERIES V745, SHEETS
4048 IV AND 4049 III
(FORT BENNING RES
MAP; 1:50,000)

TASK ORG:

TM D (-)

1/D/1-29 INF 2/D/1-29 INF TM CDR
1/3/72 EN
1/A/2-69 AR

1. SITUATION

A. ENEMY FORCES:

(1) WEATHER WILL BE GENERALLY FAIR TO CLOUDY WITH TEMPERATURES RANGING FROM 50 DEG F TO 75 DEG F. LIGHT PRECIPITATION CAN BE EXPECTED. BMNT 0600, SR 0654, SS 1754, EENT 1848.

(2) TERRAIN IS HEAVILY WOODED WITH DENSE UNDERBRUSH VIC INTERMITTENT STREAMS AND CREEKS. ROLLING HILLS CRISSCROSSED BY FOREST TRAILS. UNDERGROWTH MAY POSE A PROBLEM FOR VEHICULAR (VEH) MVMT. DISMOUNTED MVMT IS NOT IMPEDED. SWAMPS IN LOW AREAS WILL IMPEDE VEH MVMT.

(3) FWD ELEMENTS OF THE 3D GA, 17TH GD, 13TH MRR HAVE BEEN KNOWN TO BE OPERATING IN OUR AREA. THEY MAY ATK. RECON ELEMENTS HAVE BEEN OBSERVED VIC HILL 486 (GL 0702), OBJ MARS, AND HILL 446 (GL 0401), OBJ PLUTO.

(4) THE EN IS CAPABLE OF EMPLOYING DISMTD WPNS SYS, MAY ATK DISMTD OR MTD. NOT EXPECTED TO POSSESS SUBSTANTIAL ARTY SPT. NBC WPNS WILL NOT BE A SIGNIFICANT THREAT. EN TACAIR HAS SUPERIORITY.

(5) EN POSSESSES POTENTIAL TO ATK IN ZONE. MORALE IS GOOD AND EQUIPMENT/SUPPLIES ARE ADEQUATE.

B. FRIENDLY FORCES:

(1) 1ST BN 29TH INF RGT CONDUCTS MOVEMENT-TO-CONTACT 290800OCT85 TOWARD HIGH GROUND WEST OF MOORE RD, SOUTH OF MACON RD, AND EAST OF SCHATAULGA RD; BE PREPARED TO ATK NORTH TO SECURE RJ VIC GL 0404 AND CUT HIGH SPEED AVE OF APPROACH ENTERING COLUMBUS FROM THE NE.

(2) TM B/1-29 INF ATKS ON LEFT FLANK TO SECURE RJ VIC GL 0000 AND 0201.

(3) TM A/1-29 INF CONDUCTS RECON BY FIRE ON BN TF RIGHT FLANK TO GAIN CONTACT W/ENEMY.

(4) 72D EN DS TO 29 INF RGT.

C. ATTACHMENTS AND DETACHMENTS:

TASK ORG.

2. MISSION: D/1-29 INF CONDUCTS MVMT TO CONTACT 290800OCT85 TOWARD HIGH GROUND WEST OF RANDALL CREEK, SOUTH OF MACON RD, AND EAST OF RED ARROW RD (GL 0401-0702); BE PREPARED TO ATK % TO SEIZE RJ VIC GL 0704 & 0404; CONDUCT STREAM CROSSINGS; CUT EN USE OF HIGH SPEED AVE OF APPROACH ALONG BUENA VISTA RD; AND SPT OTHER D/1-29 INF ELEMENTS BY FIRE AND MANEUVER.

3. EXECUTION:

- A. CONCEPT: TM D(-) CONDUCTS MVMT TO CONTACT WITH 1/D/1-29 ON RIGHT, 2/D/1-29 ON LEFT.
- B. 1/D/1-29 INF: CONDUCTS MVMT TO CONTACT ON RIGHT OF TM D(-) ZONE USING PRESCRIBED DIR OF ATK.
- C. 2/D/1-29 INF: CONDUCTS MVMT TO CONTACT ON LEFT OF TM D(-) ZONE USING PRESCRIBED DIR OF ATK.
- D. 1/3/72 EN: FOLLOW 1/D/1-29 INF; BE PREPARED TO DESTROY/CLEAR/ELIM OBSTACLES AND MINEFIELDS; BE PREPARED TO ASSIST IN STREAM CROSSINGS.
- E. 1/A/2-69 AR: TM CONTROL.
- F. COORDINATING INSTRUCTIONS: RPT CROSSING ALL CONTROL POINTS.

4. SERVICE SUPPORT:

- A. ADMIN/LOG PER SOP.
- B. TRAINS AND MEDICS DISPLACE FM AA *. LOC TBD.

5. COMMAND AND SIGNAL:

- A. SIGNAL:
 - (1) CEOI IN EFFECT.
 - (2) EMERGENCY SIG IS RSC. VOICE: STOP MVMT.
- B. COMMAND:
 - (1) COMD W/ 1/D/1-29.
 - (2) TOC WILL DISPLACE *.

ACKNOWLEDGE

UNOFFICIAL:

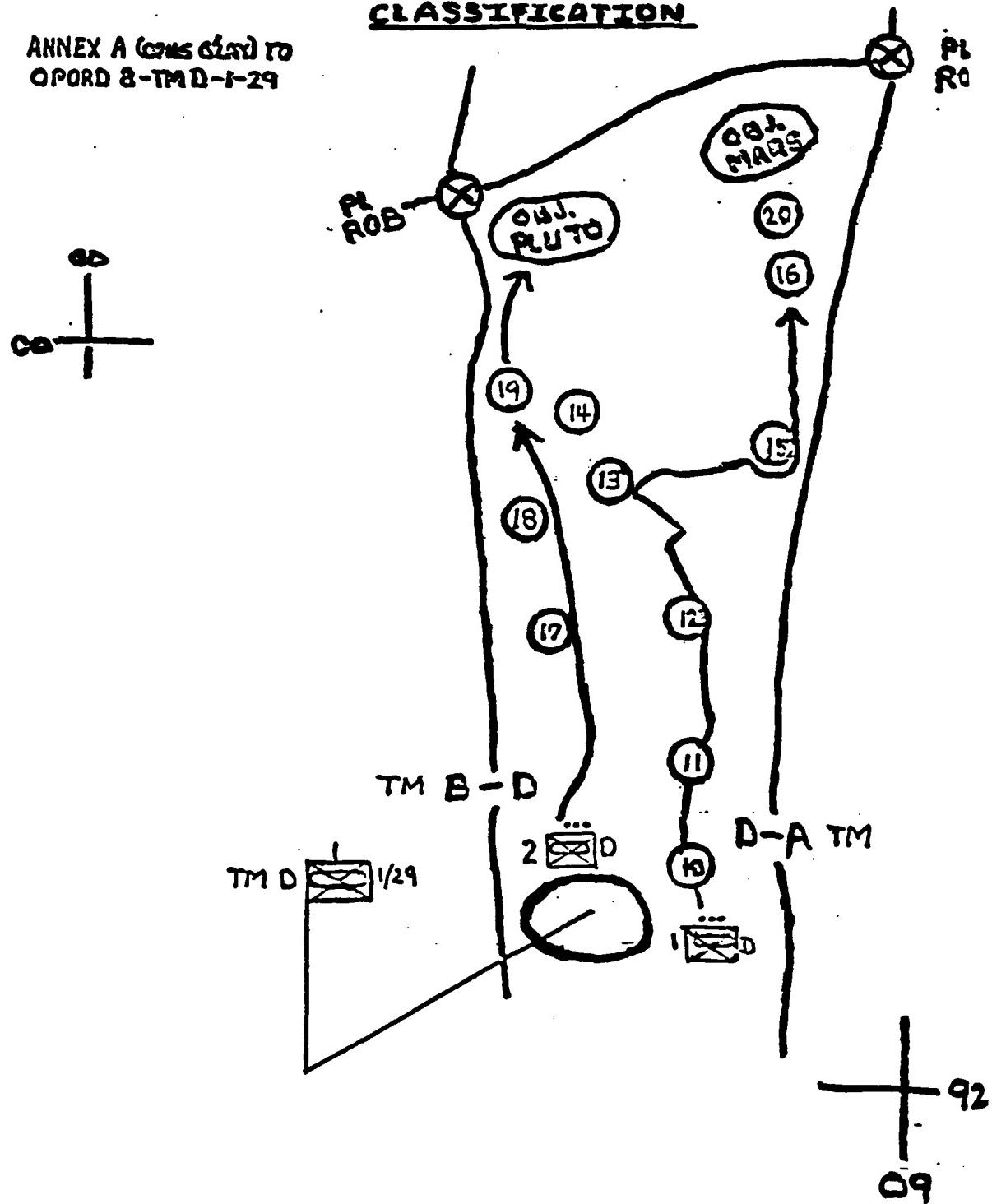
GRABER

ANNEX A- OVERLAY TO OPORD 8

ANNEX B- FIRE SPT OVERLAY

CLASSIFICATION

ANNEX A (CONT'D) TO
OPORD 8-TMD-1-29



ANNEX B (TGT LIST) TO
OPORD 8-TM D/1-29

<u>TGT #</u>	<u>DESCRIPTION</u>	<u>COORDINATES</u>
LM 1	RJ/HILL 396	GL 065933
2	RJ	060938
3	RJ	047937
4	RJ/HILL 372	067943
5	RJ	045947
6	RJ	053954
7	FORD	066954
8	RJ	048959
9	HILL 418/RJ	067963
10	RJ	051969
11	HILL 419 /RJ	068971
12	TRAIL	050981
13	HILL 480/RJ	058987
14	FORD	078985
15	RJ	047996
16	RJ	044997
17	LINEAR TGT	C43012-C44012
18	HILL 507/ROAD	075016
19	LINEAR TGT	070013-078026
20	RJ	C41C16
21	RJ	C48C18
22	LINEAR TGT	072030-07303

ANNEX B(FS O'LAY) TO
OPORD 8-TM D/1-29

01
+ 01

LM20 + LM21
+ LM17

LM22
LM19
LM18

LM16 + LM15

LM13 +
+ LM12

LM14

LM10 + LM11
+ LM8
LM6 + LM7
LM5 +

LM3 + LM2 + LM4
+ LM1

92 +
09

FRAGO (DELIB DEF)

TASK ORG: NO CHANGE

SITUATION: 29 INF RGT ORDERED TO ESTABLISH DEL DEF POSN SOUTH OF MACON RD TO CONTAIN UNITS OF 29 MRR.

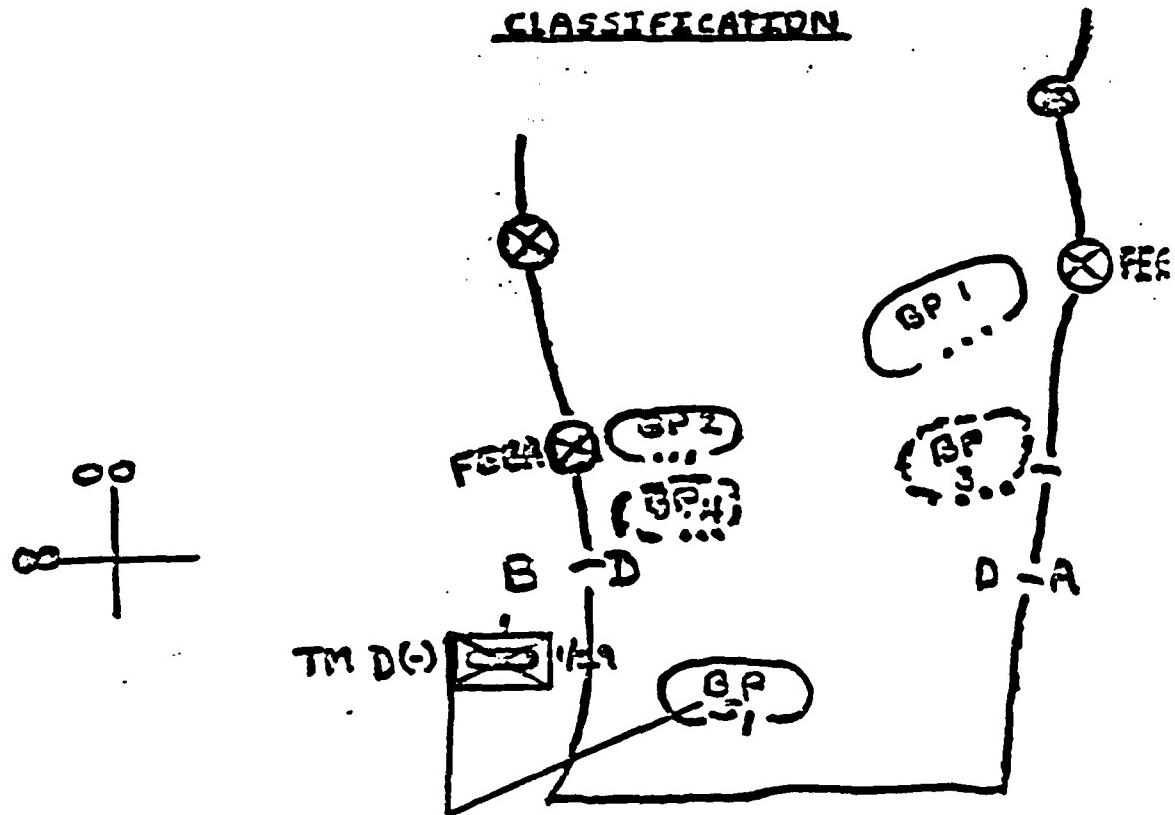
ORDERS TO SUBORDINATES:

- A. 1/D: OCCUPY BP1 ON NORTH SIDE OF HILL 486 VIC GL 074023 TO CONTROL N TO S AVE OF APPROACH. PREPARE BP3 ON HILL 386 VIC GL 078000 ASTRIDE N TO S AVE OF APPROACH.
- B. 2/D: OCCUPY BP2 TO CONTROL RJ ON HILL 446 VIC GL 050010. PREPARE BP4 ON RJ VIC GL 048005.
- C. 1/A: OCCUPY BP5 TO CONTROL RJ ON HILL 480 VIC GL 057987. BE PREPARED TO REINF 1/D OR 2/D ON-ORDER(%).
- D. 1/72: COLOCATE W/ TM D COMD GP.

FIRE SPT: PRIORITY OF BN FIRES TO 1/D.

COORD INSTRUCTIONS: NO CHANGE.

CLASSIFICATION



ANNEX A (OPNS O'LAW)
TO OPORD 9 TMD-1-29

93 —
09

FRAGO (DELAY IN ZONE)

TASK ORG: NO CHANGE.

SITUATION: 13TH MRR REINF BY 28 MRR OF 17TH GD. A MAJOR THRUST IS EXPECTED THROUGH THE TM D ZONE.

ORDERS TO SUBORDINATES:

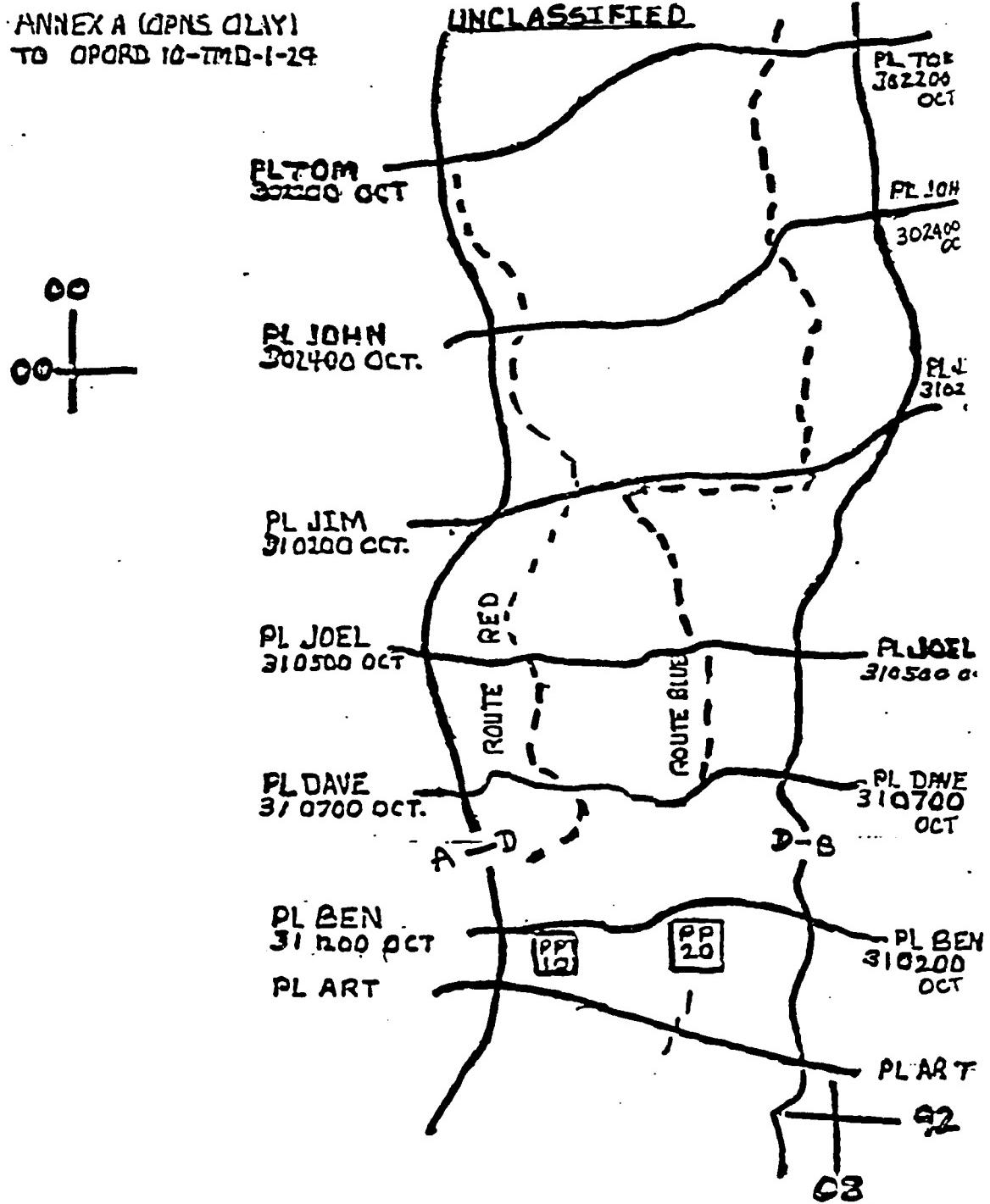
- A. TM D(-): DELAY IN ZONE. BE PREPARED TO REINF 1/D OR 2/D.
- B. 1/D: DELAY IN ZONE ALONG ROUTE BLUE. DO NOT CROSS PHASE LINES (PL) PRIOR TO DTG EST THE PL. RPT CROSSING ALL PL. USE PP20 THRU 2-29 INF.
- C. 2/D: DELAY IN ZONE ALONG ROUTE RED. DO NOT CROSS PL PRIOR TO DTG EST THE PL. RPT CROSSING ALL PL. USE PP10 THRU 2-29 INF ZONE.
- D. 1/A: DELAY IN ZONE. MOVE ONLY %. USE PP10 THRU 2-29 INF. REMAIN W/ TM D(-) COMD GP. BE PREPARED TO REINF 1/D OR 2/D.
- E. 1/72: COLOCATE W/ TM D COMD GP.

FIRE SPT: NO CHANGE.

COORD INSTRUCTIONS: NO CHANGE.

ANNEX A (OPNS OLY)
TO OPORD 10-TMD-1-24

UNCLASSIFIED



FRAGO (DEL DEF 2)

TASK ORG: NO CHANGE.

SITUATION: SITUATION STABLE. ENEMY MOVING TO SOUTH AT SLOW RATE OF MARCH.

ORDERS TO SUBORDINATES:

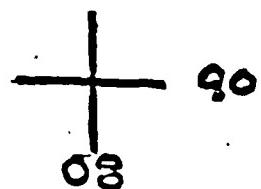
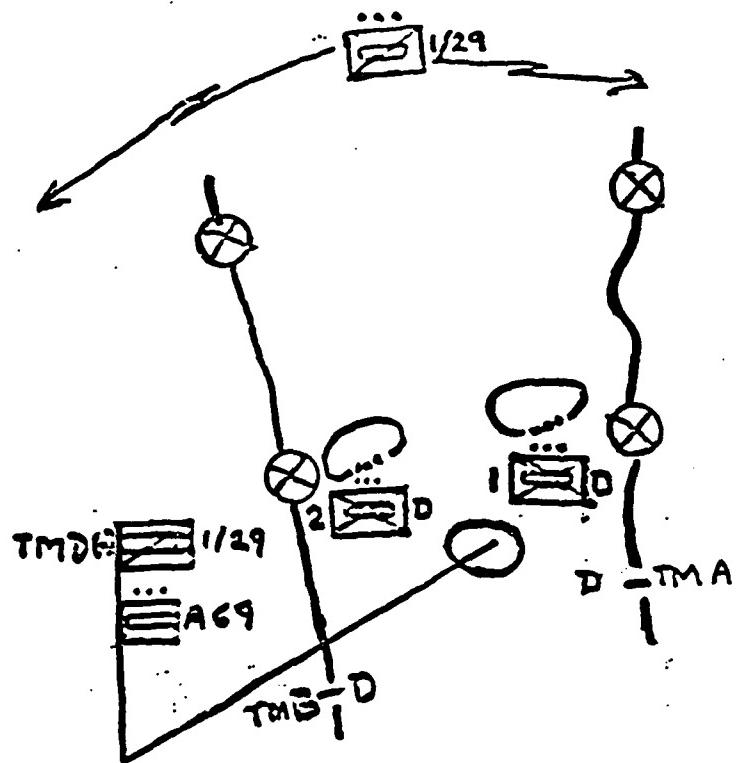
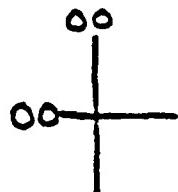
- A. TM D(-): OCCUPY BP VIC GL 063932. BE PREPARED TO REINF 1/D OR 2/D.
- B. 1/D: OCCUPY BP VIC GL 067944. BE PREPARED TO NOT RELINQUISH BP.
- C. 2/D: OCCUPY BP VIC GL 052940. BE PREPARED TO NOT RELINQUISH BP.
- D. 1/A: OCCUPY RJ VIC GL 063932. BE PREPARED TO REINF 1/D OR 2/D *
- E. 1/72: COLOCATE W/ TM D COMD GP.

FIRE SPT: NO CHANGE.

COORD INSTRUCIONS: SCT/1-29 INF SCREENING TO FRONT ACROSS ZONE. SIGNAL FOR
PASS-THRU OF SCTS: 3 BLINKS OF FIREFLY; RETURNED BY 2 BLINKS OF FIREFLY.

CLASSIFICATION

ANNEX A OPNS Q'LAY
TO OPORD II-TMA-1



FRAGO (ENDEX)

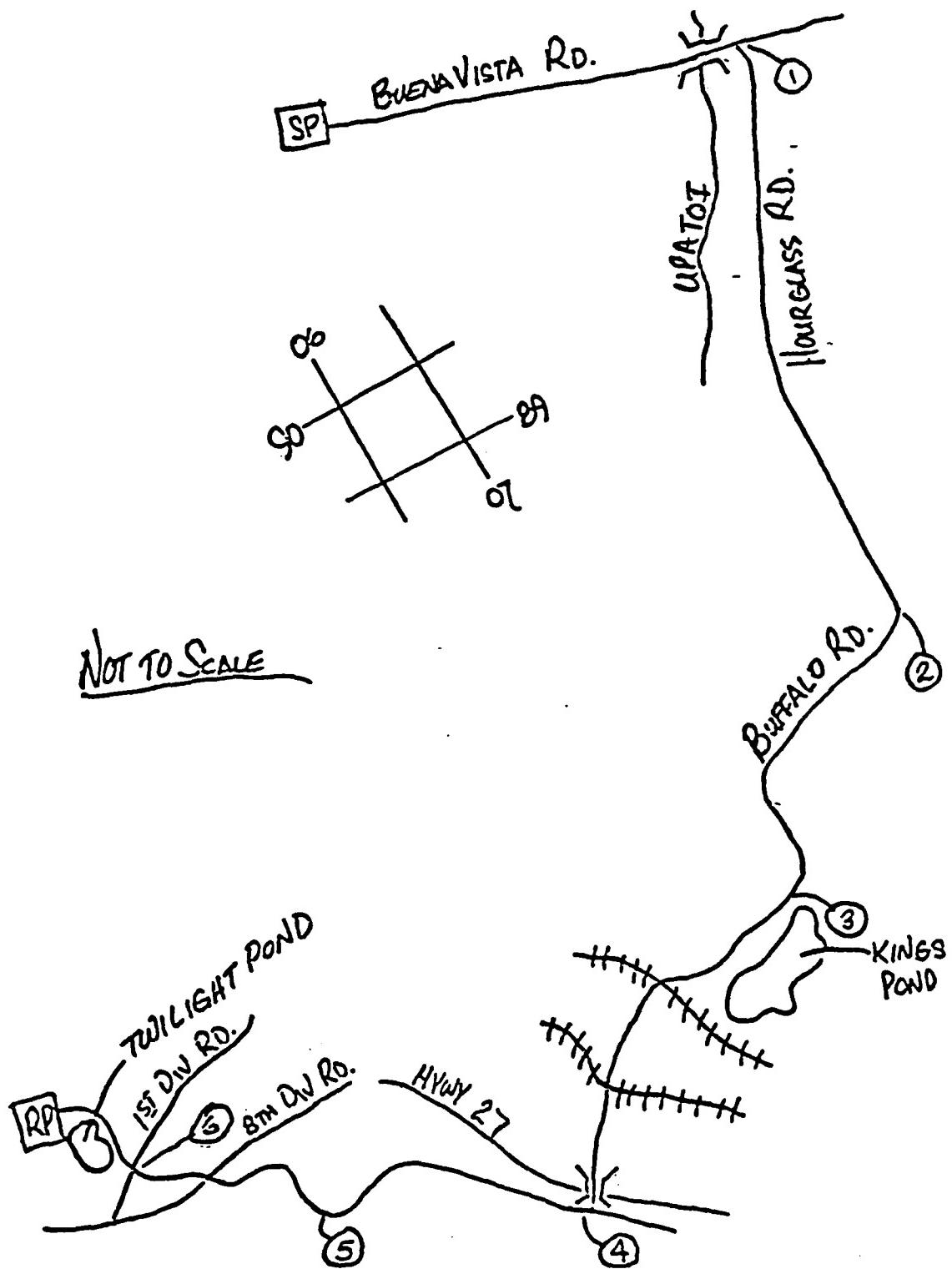
TASK ORG: NO CHANGE.

SITUATION: HOSTILITIES END.

ORDERS TO SUBORDINATES: CONDUCT TAC RD MARCH TO HOME STATION VIC GL 9884. USE ROUTE INDICATED ON STRIP MAP. PROVIDE CDR W/ACCURATE ACCOUNTABILITY OF ALL SENSITIVE ITEMS. (THIS INCLUDES PEOPLE!)

FIRE SPT: NA

COORD INSTRUCTIONS: REPORT CROSSING SP, CP, AND RP. DO NOT LEAVE MOTOR POOL UNTIL ALL VEH ARE PUT AWAY CLEAN AND ALL SENSITIVE ITEMS ARE ACCOUNTED FOR.



APPENDIX C

OBSERVER CHECKLISTS

TACTICAL ROAD MARCH

Supervise Road March Procedures:

- Order of Movement
- Speed of Movement
- Intervals Between Vehicles
- Maintain Visual Contact Between Vehicles
- Position of Key Personnel
- Start and Stop Signals

Maintain Security During Movement:

**360 Degree Observation
Weapon Ready Posture
Proper Turret Orientation
Target Priorities Assigned
Air Guards Assigned
React to Vehicle Breakdown
During Tactical Movement
(If Necessary)**

ASSEMBLY AREA PROCEDURES

Recon of Assembly Area:

**Establish Assembly Area Security
Assign Weapon Positions
Assign Vehicle Locations
Individual Fighting Positions
Enforce Physical, Light and
Noise Discipline
Ensure Commo Security**

Establish Communication
 Radio Checks
 Visual/Audible Signals
 Wire Net (If Timely)
 SOP For Reports (SIT
 Report-SPOT Report)

Supervise PMCS Vehicles and Weapons
Precombat Inspection of Personnel
Precombat Inspection of Weapons
Precombat Inspection of Vehicle
Loading

DEFENSE

	YES	NO	COMMENTS
Troop Leading Procedures			
A. Receive Order			
B. Conduct Recon			
(1) Develop Defense Plan			
(2) Develop Fire Support Plan			
C. Coordinate with Supporting/Adjacent Units			
D. Develop Order			
E. Issue Order			
F. Supervise			
Defense			
I. Planning			
A. Recon Defense Location			
B. Assign Defensive Positions			
C. Assign OP/LP			
D. Designate Areas of Responsibility			
E. Plan Final Protective Fires			
F. Code Words and Recognition Signals			
(1) Time Schedule			
(2) Signal Procedure			
(3) Deception (Movement and Signal)			
G. Use Terrain and Obstacles			

DEFENSE

	YES	NO	COMMENTS
H. Plan for Conduct of Counter Attack			
II. Execution Phase			
A. Preparatory			
(1) Establish Security			
(2) Select Vehicle and Auto Weapon			
(3) Mark and Improve Positions			
(4) Assign Sectors of Fire			
(5) Clear Fields of Fire			
(6) Identify Enemy Avenues of Approach			
(7) Identify Key Terrain			
(8) Cover, Concealment and Camouflage-Ground and Air			
(9) Prepare Alternate and Supplementary Positions		/	
(a) Recon Area - Post OP/LP			
(b) Select and Improve Positions			
(c) Clear Routes Rehearse Movement			
(10) Make Range Cards, Sector Sketches, Platoon Overlays			
(a) Vehicle Positions, Weapons and Range			
(b) Dismount Postions, Weapons and Range			

DEFENSE

	YES	NO	COMMENTS
(c) Sectors of Fire (Primary, Secondary)			
(d) Range to FPL, PDF			
(e) TRPs			
(f) Dead Space			
(g) Obstacles			
(11) Coordinate Fire Support Plan			
(a) Locate Targets (FEBA, TRP)			
(b) Call for Indirect Fire (Timing-Type)			
(c) Adjust Indirect Fire			
(d) Arrange Coverage of Obstacles			
B. Execution			
(1) Detect Enemy Movement			/
(2) Call for Supporting Fires			
(3) Withdraw OP/LPs			
(4) Employ Defensive Fires			
(5) Call for FPFs (If Necessary)			
(6) Counterattack (If Appropriate)			
III. Reorganization			
A. Treat/Evacuate Casualties			
B. Fill Key Positions			
C. Fill Crew-Served Weapon Positions			

DEFENSE

	YES	NO	COMMENTS
D. POWs to Collection Point			
E. Rest and Feed Troops			
F. Request Replacements			
IV. Weapons			
A. Service-Troubleshoot			
B. Reload/Redistribute Ammunition			
C. Request Ammunition Resupply			
V. Consolidate			
A. Re-establish Security			
B. Clean Up Pockets of Resistance			
C. Designate Sectors, Positions			
D. Plan Supporting Fires			
E. Submit Status Report			
F. Reconstitute the Defense/Prepare for Next Attack			

DELAY

	YES	NO	COMMENTS
Troop Leading Procedures			
A. Receive Order			
B. Conduct Recon			
(1) Develop Scheme of Maneuver			
(2) Develop Fire Support Plan			
C. Coordinate with Supporting Units			
D. Develop Order			
E. Issue Order			
F. Supervise			
Delay			
I. Planning			
A. Receive Order			
B. Coordinate			
C. Recon Route of Withdrawal			
D. Route Marking - Use of Guides			
E. Code Words-Recognition Signals			
F. D.L.I.C.			
(1) Time Schedule			
(2) Disengagement			
(3) Signal Procedure			
(4) Deception (Movement and Signal)			
G. Develop Positions in New Area			
H. Control Points, Phase Lines, Timing			

DELAY

	YES	NO	COMMENTS
I. Use of Darkness, Terrain			
J. Use of Obstacles			
II. Execution Phase			
A. Preparatory			
(1) Recon			
(2) Quartering (If Appropriate)			
(3) Movement of Nonessential Elements			
B. Disengagement Phase			
(1) Initial Movement to Rear			
(2) Break Contact			
(3) Movement to Rear: Route, Guides, Assembly Points			
C. Security Phase			
(1) DLIC Assist Movement of Main Body			
(2) DLIC Protects Movement of Main Body			
(3) Security Force Moves to New Positions			
D. Return Command of DLIC to Commander on New Position			
(1) Procedures and Signal for Link up			
(2) Guides/Preselected Positions at New Location			

ATTACK

	YES	NO	COMMENTS
Troop Leading Procedures			
A. Receive Order			
B. Conduct Recon			
(1) Develop Scheme of Maneuver			
(2) Develop Fire Support Plan			
C. Coordinate with Supporting Units			
D. Develop Order			
E. Issue Order			
Attack			
I. Planning			
A. Receive Order			
B. Coordinate			
C. Perform Recon			
D. Make Route of Advance, Use Guides, etc.	/		
E. Timing of Attack LD Time, etc.			
F. Formations/Technique of Movement			
G. Specify Weapons Ready Posture			
H. Assign Targets and Priorities			
I. Coordinate Lift or Shift of Supporting Fires			
J. Specify Limit of Advance			
K. Assign Areas of Responsibility Once Objective is Secured			

ATTACK

	YES	NO	COMMENTS
II. Execution of Attack			
A. Occupy Attack Position on Time			
B. Cross LD on Time			
C. Proper Tactical Formation			
D. React to Direct and Indirect Fire			
(1) Return Fire with Appropriate Weapons			
(2) Call For, Lift or Shift Indirect Fire			
(3) Seek Cover, Move to Alternate Positions			
(4) Report to Higher Headquarters			
E. If Appropriate, Suppress ATGM Gunner and/or Avoid Missiles by Driving Techniques		✓	
F. Use of Fire			
(1) Patterns of Fire			
(2) Fire Commands			
(3) Utilize Effective Range of Weapons			
(4) Assign Targets of Opportunity to Vehicle(s)			
G. Build Up Volume of Fire			
H. Lift or Shift Supporting Fire			
I. Crossover Objectives			

BIFV PACK AND VEST

Comment Sheet

	YES	NO	NO REPONSE
I. Mission			
Does pack/vest improve ability to accomplish mission:			
A. Mounted			
B. Dismounted			
II. Use			
A. Vest			
1. Is vest more comfortable than issue LCE?			
2. Does vest enable you to move about inside the vehicle more freely?			
3. Does the vest allow carrying of the necessary ammo load?			
4. Is the vest adjustable for specific missions?			
5. Does the vest adjust for different individual body configurations?	/		
B. Pack			
1. Does pack have enough space for necessary gear?			
2. Does the pack adjust for different body configurations?			
3. Does pack allow carrying necessary load comfortably?			
4. Does pack allow loading for specific missions?			

WILD NIGHT VISION GOGGLES, "CYCLOPS"

Comment Sheet

	YES	NO	NO REPONSE
I. Mission			
A. Does the system aid mission?			
B. Does the system improve control during limited visibility conditions?			
C. Does the system improve limited visibility security?			
II. Use			
A. Is the system usable during limited visibility conditions?			
B. Is the system usable from a moving vehicle?			
C. Is the system useable to an adequate range?			
D. Is the system tiring to use?			
III. Reliability			
A. Does the system require unforseen maintenance?			
B. Is battery life adequate?			
C. Does the system have vision or focus problems?			

INFRARED FIREFLY

Comment Sheet

	YES	NO	NO REPONSE
I. Mission			
A. Does the device aid the mission?			
B. Does the device improve limited visibility control and recognition?			
C. Does the device improve limited visibility security?			
II. Use			
A. Is the device usable during limited visibility conditions?			
B. Can the device be used from a moving vehicle?			
C. Is the device usable to adequate distance?			
D. Can the device be rendered directional?	/		
III. Reliability			
A. Does the device require unforseen maintenance?			
B. Is the battery life adequate?			

SEE THROUGH CARGO HATCH COVER

Observer Log Sheet

Observer _____
Vehicle Number _____

Estimated Amount of Use

Day 1

Day 2

Day 3

Maintenance Required

Day 1

Day 2

Day 3

User Questions or Comments:

(Observer will list name, position and date/time group for any questions or comments)

Any instance where the "see through" hatch cover effected the way in which the mission was accomplished.

Type of Mission --

Effect of "see through" hatch cover --

INFRARED FIREFLY

Observer Log Sheet

Observer _____
Vehicle Number _____

Time Used

Day 1

Day 2

Day 3

From:
To:

From:
To:

From:
To:

Total Hours:

Total Hours

Total Hours:

Maintenance Required

Day 1
Day 2
Day 3

User Questions or Comments:

(Observer will list name, position and date/time group for any questions or comments)

Any instance where the firefly effected the way in which the mission was performed.

Type of Mission (e.g. Patrol) --

Effect of Firefly --

WILD NIGHT VISION GOGGLES, "CYCLOPS"

Observer Log Sheet

Observer _____
Vehicle Number _____

Time Used

Day 1

From:
To:

Total Hours:

Day 2

From:
To:

Total Hours

Day 3

From:
To:

Total Hours:

Maintenance Required

Day 1

Day 2

Day 3

User Questions or Comments:

(Observer will list name, position and date/time group for any questions or comments)

Any instance where the firefly effected the way in which the mission was performed.

Type of Mission (e.g. Patrol) --

Effect of Cyclops --

APPENDIX D
EXERCISE NARRATIVE

The tactical field testing exercise was conducted over a period of three consecutive days. The exercise began with a tactical road march from the battalion motor pool to a forward assembly area located in Training Area Oscar. The road march began with platoon personnel alert and turret weapons oriented to maintain 360 degree security. Upon arrival at the assembly area, some individuals were asleep in the vehicle and all turret weapons were at the 12 o'clock position. There was no standing operating procedure in use for stowage of personal gear on the vehicles and the squad appeared to be confused on dismounting and milled about purposelessly. The OPORD was given once the assembly area had been occupied and local security established.

The tactical scenarios were sequenced to provide a logical progression of events. The OPORD was for the platoon to conduct a movement to contact and a limited objective attack. Upon receipt of the order, the platoon leader: (a) conducted a map reconnaissance of the route of advance specified in the OPORD; (b) developed a scheme of maneuver and a fire support plan; (c) made initial coordination with supporting/adjacent units; and (d) alerted his key personnel to prepare to receive the order.

The platoon leader, with the assistance of the platoon sergeant, developed the detailed order for the movement to contact and limited objective attack. The order was then given to the squad leaders and other key personnel for dissemination to the platoon. The order contained the following information: the route of advance, the location of and time of crossing the line of departure, formations and techniques of movement, weapons ready posture, target priorities, coordination for lifting and shifting defensive fires, the limit of advance and areas of responsibilities once the objective had been secured.

The platoon moved from the assembly area and crossed the line of departure on time. As the platoon conducted the movement to contact, they encountered several delaying actions/attempted ambushes by the opposing forces. There was some confusion as the dismount element moved to clear the delay/ambush positions. In one instance the platoon leader and platoon sergeant were with the assault element leaving the BIFVs with no direction or control. At this point, two BIFVs became temporarily separated from the platoon. As the movement to contact continued, the platoon became more cohesive and the leaders were exercising better control with less effort. Due to the fact that the platoon was moving tactically, they were able to capture an OPFOR squad and vehicle approximately one kilometer from the objective, and met no resistance in taking the objective. During the movement to contact, a variation from doctrine was noted in that the squad leader and assistant took turns dismounting. The platoon leader called for supporting fires at each contact.

Upon crossing over the objective, the FRAGO was received to conduct a hasty defense at that location. The platoon leader then performed troop leading procedures. The defensive location selected by the platoon leader was viable, however, it did not allow effective coverage of a crossroad and a high speed avenue of approach. No escape route was designated or reconned from the

defensive position. The platoon leader accompanied a reconnaissance patrol, but gave the platoon no code or password. The platoon sergeant did not know that the platoon leader had accompanied the patrol. Upon the return of the patrol, the platoon leader held a meeting with his squad leaders and key personnel and established code words and recognition signals. As a result of the reconnaissance patrol, the platoon leader was able to establish effective security and supporting fires for a 360 degree defense; however, range cards and a platoon fire plan were not prepared and sectors of fire were assigned only to machineguns and vehicle weapons.

Enemy probes were detected and engaged three times during the night. The probes were engaged with individual weapons and crew served weapons maintained good fire discipline. The opposing force attacked at 0645 and the platoon was able to repulse the attack and capture three prisoners. The prisoners were brought to the defensive position unblindfolded. The platoon leader called for immediate evacuation of the prisoners to the rear. There was no need for reorganization and consolidation following this attack.

The platoon leader then received a FRAGO to move approximately 1 km to the south and prepare/conduct a deliberate defense. A reconnaissance of the defensive position was performed but squad positions were not assigned. The squads moved into the defensive position and set up. Some squads did not make effective use of available cover. Squad members were aware of their specific mission but, when questioned, were not aware of their relationship to the overall plan. The range cards prepared by the squads bore no relationship to the standard range card and the sector sketch was also non-standard. Fighting positions were dug and improved; however, camouflage was minimal, if used at all. No passive air defense measures were taken. At mid-morning one of the platoon OPs detected an enemy patrol and the platoon sent out a counter patrol that was able to capture the enemy force. The prisoners were once again brought into the defensive position without blindfolds. The air attack occurred in the early afternoon and caught the platoon unprepared. An initial lack of control was apparent. The platoon leader and platoon sergeant were able to organize an effective response to the air attack and at this time the opposing force laid a smoke screen and launched a ground attack. The platoon sergeant was the key element in suppressing the enemy ground attack, rallying the troops and leading a counterattack. The entire first squad had gone in pursuit of the enemy, leaving a gap in the platoon defense. The counter attack was aggressive and carried out with so much enthusiasm that an entire squad of the attacking force was captured.

Following a quick reorganization and consolidation, the platoon leader received a FRAGO to conduct a delay in zone back to a specified defensive position. The delay was to begin at 2200 hours. The platoon leader conducted a map reconnaissance of the route specified in the order and determined that neither route markers nor guides would be necessary. The plan was to conduct a phased withdrawal with a detachment left in contact; the platoon would then delay on successive positions along the planned route. Preplanned fires were plotted to cover the withdrawal. Withdrawal from the defensive position was well organized and good order was maintained.

While conducting the withdrawal, the platoon conducted a successful ambush at a choke point on the withdrawal route. The platoon moved into the defensive

position on time. The position had been physically checked out by the platoon leader and squad positions selected prior to the vehicles moving in. The terrain, cover and concealment were used to good advantage by the defenders; however, there was no use of real or simulated obstacles. Camouflage was used to good effect to afford concealment from ground observation. Two of the vehicles were effectively camouflaged from both ground and aerial observation. The platoon leader had planned fire coordinations covering both his front and the high speed avenue of approach. The platoon had time to prepare defense and improve the squad positions before the attack began. Contact was initiated by an air attack and the platoon reacted in a disciplined, coordinated manner. The air attack broke off and was followed by a smoke screen and ground attack. None of the confusion of the initial air and ground attack was visible. The platoon was able to repel both the air and ground attack and then launch an effective counterattack. Once the enemy had broken contact the platoon leader reorganized and consolidated the platoon and tightened his defenses. At this time the exercise was terminated.

APPENDIX E
EQUIPMENT STUDIES

Introduction

Three diverse areas which surfaced as issues during the initial problem analysis relate to "friendly vehicle identification," "BIFV crew member combat pack and vest," and "new night vision devices." While each area represents an important need for full BIFV combat effectiveness, the extensive scope of work planned for other tasks during the second year of the BIFV research project required the assignment of a relatively low priority to these issues.

However, the research team did investigate a number of equipment solutions to the defined problems in each area, and promising prototype items were purchased or fabricated during the second year. The span of control study conducted during October, 1985, presented a research opportunity for exploring the capabilities of these equipment items. The results of this limited feasibility testing are presented below.

Friendly Vehicle Identification

Problem Definition

Differentiation of friendly from enemy elements is one of the most critical tasks for the BIFV commander and gunner. Given that projections for future conflicts postulate a highly fluid battlefield and increased requirements for fighting under limited visibility conditions, the ability to rapidly determine whether a detected vehicle or dismounted element represents a threat will continue to be critical to survivability and mission success.

During the on-site visits to observe BIFV unit ARTEPs, the research team noted instances where BIFV crews "successfully" engaged and killed friendly vehicles thinking they were enemy. This finding is attenuated by the fact that the OPFOR typically uses U.S. Army vehicles during ARTEPs. However, reports from the National Training Center also cite kills of friendly vehicles when the OPFOR was using vehicles visually modified to represent Threat equipment. The alarming frequency with which own forces are engaged by friendly fire during training simulations should alert commanders and trainers to the probable disastrous consequences in actual combat.

Current training is insufficient to make troops proficient in friendly element recognition even though such training is incorporated in the BIFV courses conducted by USAIS and training materials available to the units. Additional training and/or equipment developments are required to improve proficiency in battlefield recognition and identification, and a committant reduction in the incidence of fratricidal engagements.

At the conclusion of the initial phase of the project, the research team recommended that future work be initiated for both the training and the

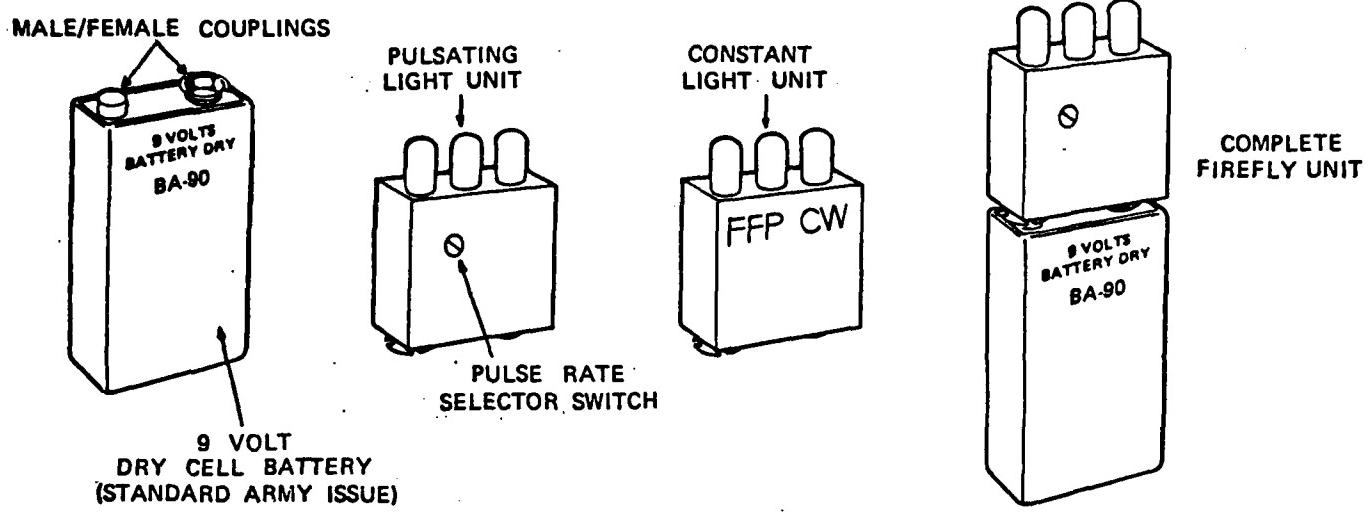


Figure E-1 The Firefly infrared emission device.

members in identifying friendly positions. General reaction on the part of squad members was highly positive toward the potential uses of the device in friendly element identification.

It was concluded that the observed characteristics and capabilities of the device merit further work to formalize procedures and techniques for employing such equipment to aid secure friendly identification of dismounted personnel and individual vehicles (through the use of coded pulses). Additional modes of employment such as identification of the front line trace and location of adjacent units should also be explored in depth.

BIFV Crew Member Pack and Vest

Problem Definition

In the combat environment, BIFV crew members will normally wear a combat vest continuously while in the vehicle. The pack will be stowed inside the vehicle or in the bustle rack outside the vehicle for crew members to put on when dismounting for lengthy operations away from the BIFV. Two areas of consideration dictate the optimum design for these items of equipment; these are the special characteristics of the Bradley vehicle itself and the types of mechanized operations crew members will encounter.

First, the troop compartment of the vehicle--when combat loaded and carrying a full complement of troops--has many projecting surfaces and allows little room for unimpeded movement. The problem tends to increase during prolonged operations as clutter accumulates inside the vehicle. Therefore, streamlined design of the load bearing equipment (LBE) worn by crew members is important. Present equipment tends to hang up on projections, and this is of particular concern when quick exit of the vehicle is critical. The current load bearing equipment has a suspender strap arrangement which is particularly prone to snagging. The gunner and commander, for example, must operate freely within an equipment-filled turret and may have to exit rapidly through the hatch or turret shield door into the troop compartment. Personnel in the troop compartment must perform the reload procedure, operate the firing port weapons, unstow the weapons organic to dismounted operations, and perform other tasks that require rapid and unimpeded movement. All personnel may have to make a hasty exit through the ramp door without interruption.

Secondly, since dismounted operations away from the vehicle will be of limited duration for BIFV crew members, the pack design can be more compact than that worn by other Infantry personnel. The Integrated Individual Fighting System (IIFS) that was recently developed by Natick Laboratories includes two items of particular interest here. These items are the Tactical Load Bearing Vest (TLBV) and the Field Pack, Large with Internal Frame (FPLIF). These items will serve infantrymen well when they are operating in the traditional role, but the large carrying capacity is more than is required for the special needs of the BIFV crew member. Given the multiplicity of essential items to be carried within or on the Bradley, reduction of space requirements for any item of equipment is essential.

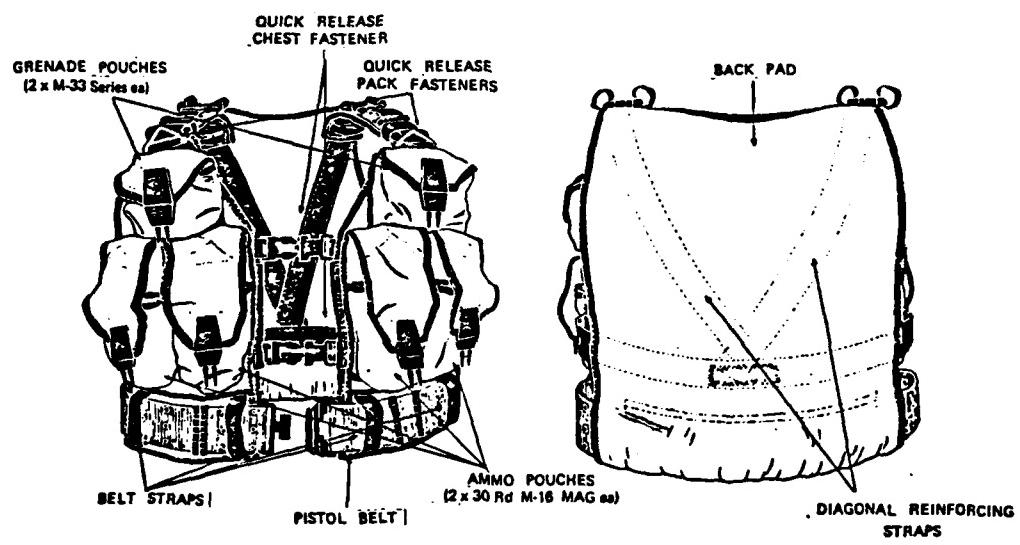


Figure E-2. BIFV combat vest.

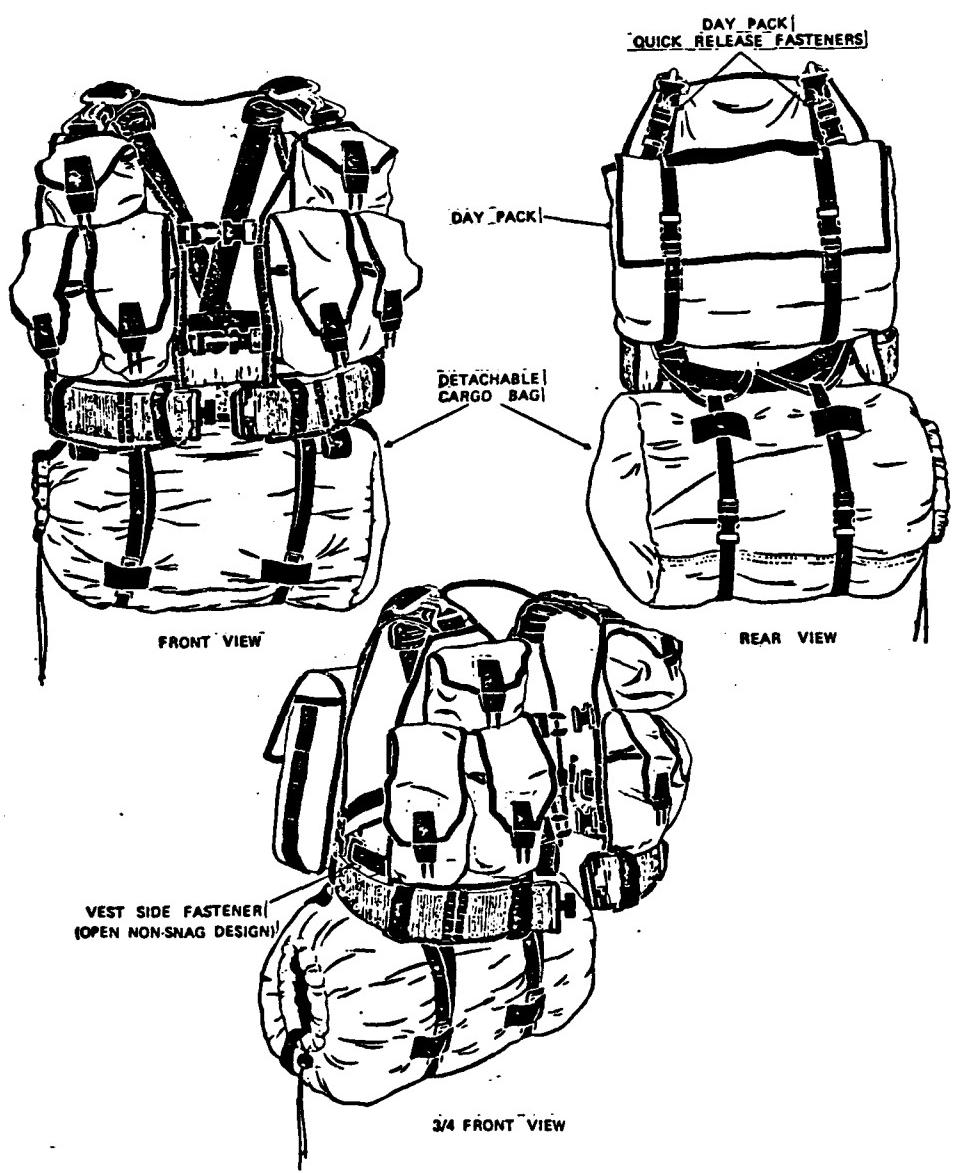


Figure E-3. BIFV pack.

Design Feasibility

A prototype of the modified vest/pack designed by ARI/Litton was fabricated by the firm of Adventures Unlimited at no cost to the government. Opportunity to conduct limited feasibility testing arose as a result of the previously scheduled tactical exercise designed to investigate platoon/squad leader span of control.

One of the commanders assigned to support the tactical exercise wore the modified vest during the first two days of the exercise. During the final day, the gunner in that vehicle was issued the vest. The research team member serving as an observer in that vehicle noted the performance of the vest as part of his overall duties. Comments by the users were collected during the exercise and a post-exercise questionnaire on the vest was administered.

The observer noted that there were no instances in which the vest failed to perform as designed. Users commented spontaneously that they had not been able to discover a way to induce snagging inside the vehicle. Questionnaire results indicated that users felt the modified vest was more comfortable than issue equipment, allowed more freedom of movement, adjusted well to individual body configurations, allowed for carrying the required ammunition load, and was versatile enough to accommodate the needs of different types of missions.

The results of the limited field test of the prototype BIFV vest and pack indicate that the design concepts merit further exploration. The needs of the BIFV crewman are sufficiently special to support consideration of the decision to field special purpose equipment. The prototype vest shows promise for answering the need for "streamlined" LBE worn by the crewman within the crowded confines of the Bradley. The prototype pack will accommodate the requirements for BIFV dismounted operations and address the further need for stored packs to occupy as little volume as possible when the Bradley is fully combat loaded.

Monocular Night Vision Device

Problem Definition

During the problem analysis phase, the BIFV research team emphasized the particular requirements of BIFV operations during night or daytime limited visibility conditions. Therefore, the entire range of Surveillance, Target Acquisition and Night Observation (STANO) devices were investigated. Opportunities to improve upon either the training for or the design of the vision enhancement devices currently organic to the BIFV were sought. For example, extensive research and development work with the thermal mode of the Bradley Integrated Sight Unit (ISU) was completed.

This section describes investigative work focused upon night vision goggles to be used by the individual crewman. The present model specified by TO&E for BIFV units, the AN/PVS-5, represents the culmination of several generations of developmental work. The original intent of the research team was to investigate the utility of the AN/PVS-5 in three distinct areas: (a) the suitability of the device for use in tactical situations at company level

and below; (b) employment of the device in a surveillance system that integrates all the vision enhancement devices organic to the Bradley; (c) the value of the device as a tool for basic research to give observers increased capability for monitoring BIFV operations during night/limited visibility conditions.

The original aims had to be modified when it was determined that the supply of AN/PVS-5 night vision goggles available at Fort Benning is limited and is in constant use for instruction. Therefore, six commercially available models, for use by the research team during data collections activities involving BIFV operations under limited visibility conditions, were purchased. The device selected was the Wild Night Vision Goggles, designed and manufactured at a cost of \$5000 by the Wild Corporation of Switzerland, that is sensitive to both infrared and ambient light. In contrast to the AN/PVS-5, this device utilizes a monocular system that has come to be known generically as "Cyclops." Figure E-4 presents a schematic of this device.

Observations

As noted, the AN/PVS-5 is an item already in the BIFV inventory and the performance of this device when employed in a small unit tactical surveillance plan should be investigated systematically in future work. The Wild Night Vision Goggle was obtained mainly as a data collection aid to be used in future work by research team members. An opportunity to explore the performance of this device arose during the conduct of a tactical exercise focusing upon platoon/squad leader span of control issues. Observations resulting from this limited field experience are presented here, with the reminder that no systematic comparison of the two devices (WILD vs AN/PVS-5) was planned and the observations that follow do not imply any comparisons.

During the tactical exercise, the Wild version of the night vision goggle was issued to the friendly force platoon leader and the three squad leaders. They were used as an aid to vision during darkness and periods of limited visibility. User comments indicated a high level of acceptance of the device. It was not possible to define the exact parameters or maximum upper limits for all the characteristics that would be required of individual night vision goggles, but a number of assets of the device can be noted in general terms. Its light weight will permit extended periods of use before onset of strain in the neck and shoulder areas. The clarity of the image remains high out to extended ranges. Recovery of night vision after use is momentary and no excessive eye strain was noted. The IR light emitter facilitated map reading and other close-up work. Finally, users noted that the sound produced by the device when in operation did not interfere with normal hearing and did not have a significant noise signature range.

In light of the positive results obtained in the exploratory field evaluation, the research team plans to utilize the Wild device during future data collection efforts. It is difficult to maintain experimental control and obtain comprehensive observations during research in the limited visibility area. The Wild night vision device will afford the researchers the assets of unlimited mobility within the field research site, an excellent field of view, and freedom from dependence on issue night observation equipment.

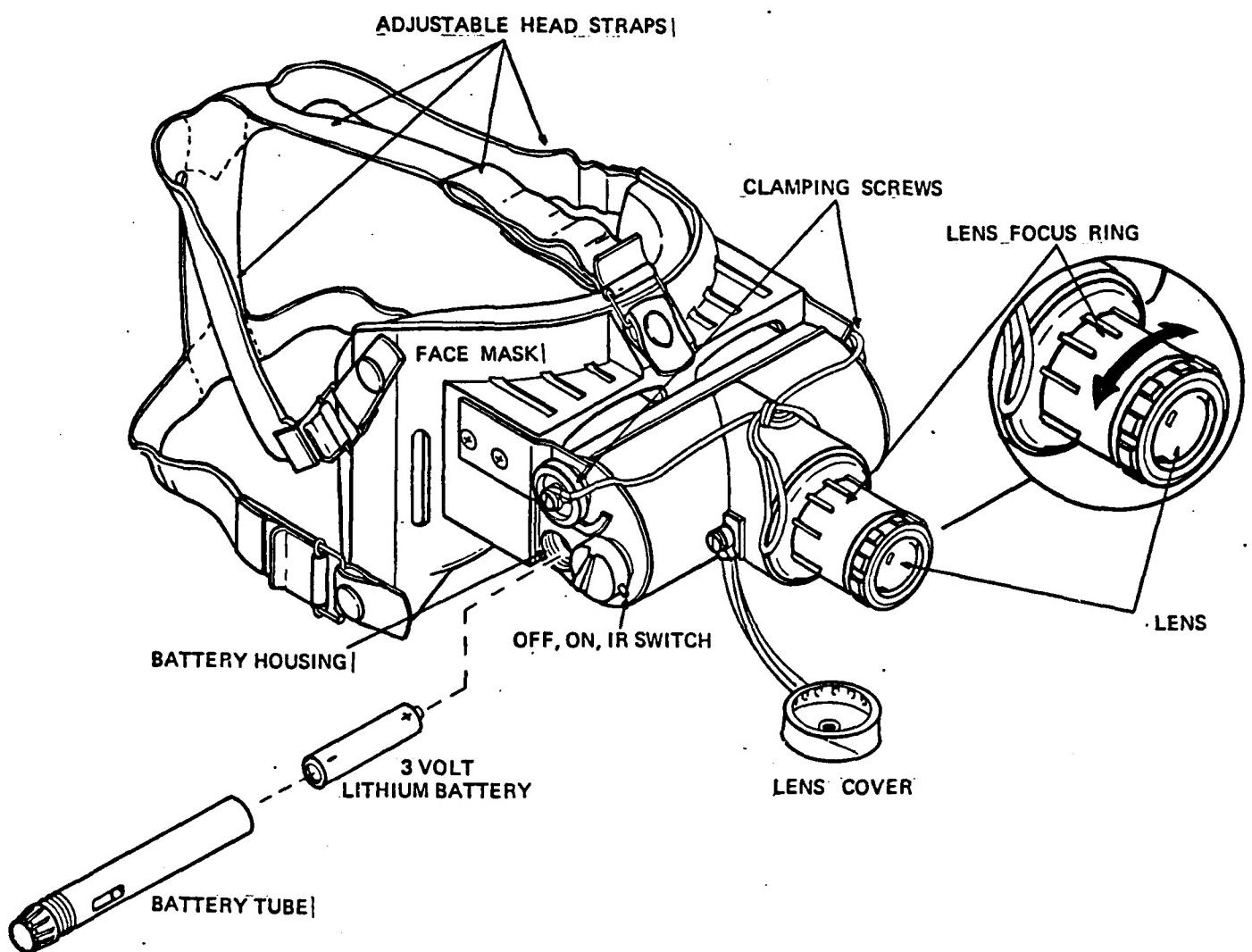


Figure E-4. The WILD night vision device.

Finally, future systematic work focusing on AN/PVS-5 will be conducted to produce a data base specific to the performance of this device and procedures for its use in a coordinated battlefield surveillance plan.

Summary

As described above, the research team conducted exploratory work in the three areas of battlefield identification of friendly elements, the load bearing equipment provided to BIFV crewmen, and individual night vision goggles. These surfaced as problem areas during the first phase of the BIFV project but, per coordination with the Army Research Institute and the proponent, they were assigned a relatively low priority within the overall scope of work for the second year.

However, it was possible to obtain or fabricate promising prototype items and the research team created an opportunity for limited exploration of the concepts by including simplified tests during the conduct of major research investigating platoon/squad leader span of control. This field exercise was conducted during the final two months of the present contract and the satellite tests were necessarily limited in scope so they would not interfere with the major aims of the span of control study. Useful experience in the three areas did result and observations are presented here for information. Additional work to be conducted during the next two-year contractual period will be guided by the exploratory results.